

DOMAINS IN PHONOLOGY:  
WITH EVIDENCE FROM ICELANDIC, FINNISH & KIKUYU  
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For my mum and dad  
with much love and gratitude.

## ABSTRACT

In this thesis I consider the way in which morphology is visible to phonology. I begin by stating, in accordance with Kaye 1992 and Kaye and Vergnaud 1990, that only some morphology is visible to the phonology. In forms which have Analytic (visible) morphology domain final phenomena, for example, word final nuclear licensing, are visible word internally.

I present analyses of three well-known processes - Icelandic aspiration, Finnish consonant gradation and Dahl's Law in Kikuyu - within the framework of Charm and Government Phonology (Charette 1991, Kaye, Lowenstamm and Vergnaud 1985 and 1990). I show that it is possible, and advantageous, in the light of previous studies, to deal with each of these processes within a Principles and Parameters based framework.

I introduce a new constraint - The Cyclic Spreading Constraint - into Government Theory, consider right to left proper government in Finnish, and show that languages vary parametrically in whether or not they allow segments to act as governors both within, and across, domains.



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## PREFACE

Whenever possible orthographic forms are used for language examples and are delimited according to the usual conventions by < >.

In cases where such forms can be misleading examples are presented in what I call linguistic orthography. These forms are delimited as "" and will act as an informal illustration of the data in question. The forms in linguistic orthography represent no linguistically significant level of representation and should be viewed as having identical theoretical status to those forms which are presented in standard orthographic notation.

The inverted commas "" convey to the reader information which corresponds to broad phonetic transcription. It is hoped that the inverted commas will remind the reader that such renditions have no theoretical status.

Thus, in linguistic orthography, the Icelandic form "dehpli" 'dot' has an adjacent "p" and "l" in spite of the fact that they are not adjacent at any linguistically significant level of representation within the framework adopted here.

## INTRODUCTION

### THE INTERFACE OF MORPHOLOGY AND PHONOLOGY

This thesis considers the nature of the contribution which morphology makes to phonology. The position reached comes about naturally from a particular way of viewing phonological processes. I begin by considering some possible and some previous answers to the question: what aspects of morphology are accessible to phonology?

#### 0.1 THE NULL HYPOTHESIS

##### 0.1.1 THE AMERICAN STRUCTURALISTS

The null hypothesis, espoused by the American structuralists (e.g. Joos 1958), is that morphology plays no part in phonology. The structuralists used a phonemic analysis which grouped phones into phonemes if they were in complementary distribution and if they were 'phonetically similar'. In determining this distribution morphological information could not be taken into account so that the 'mixing of levels' was avoided. The Structuralist claim was that taking morphology into account when positing phonological structures motivated a circularity, as it was these same phonological structures on which the morphological analyses would be based.

One result of this standpoint was that any correlation between, for example, the restricted occurrence of certain clusters and morphological structure, was viewed as being completely accidental. In English, a group such as "gz" as in "bagz" can occur only in morphologically complex forms: the word <parenthood> has an internal "th" sequence

which is not found randomly distributed throughout English forms but appears only in compounds. In keeping with the structuralist position Hooper (1975) argues that the restricted occurrence of such clusters as "gz" and "gd" is the result of historical accident. She claims that as such forms are "perfectly pronounceable [English]/LG" there can be no constraint against there being morpheme final obstruent clusters. To use pronounceability as the criterion for validating any sequence of sounds as a possible morpheme final sequence leads to the claim that any word (as all words are pronounceable) must be a licit morpheme. One possible consequence of this position would be to view the cluster at the end of "siksths" as a possible morpheme final cluster which just does not happen to occur anywhere else in the English language. Such a claim seems empirically inadequate, not only for English but for virtually any language, as it predicts that the sequences of sounds in morphologically complex words should be indistinguishable from those sequences in forms with no morphology. This is clearly contrary to the data, as we can see when we compare the occurrence of, for example, the 'gd' sequence which only occurs in complex forms such as 'bagd' 'mugd', with the sequence 'lt' in simple forms such as 'pelt', 'alter', etc.

The restricted occurrence of certain sequences can be seen as evidence for morphological input of some kind to the phonology. The completely opposite view to that of the null hypothesis is that taken by exponents of the theory of Lexical Phonology (LP). I now briefly consider and discuss the form of the interface proposed within the LP framework (Mohanan 1982, Halle 1986).

#### 0.1.2 LEXICAL PHONOLOGY

Within the model of Lexical Phonology there is much theory internal diversity. In the brief discussion which follows I restrict myself to the points which, to my knowledge, are

generally accepted by most linguists working within the LP framework. The shortcomings of the theory touched upon in this section are problems of theoretical restrictiveness which can be seen as underlying the most general principles of the theory rather than relating to particular aspects of specific versions.

The Lexical Phonology approach organizes the rules of morphology and phonology into blocks or strata. In all of these strata rules of affixation (morphology) are ordered before the rules of phonology. In the lexical stratum each affixation is followed by the application of all the phonological rules labelled as applying at the lexical level. In the post lexical stratum phonological rules which have been labelled as post-lexical apply after all morphological processes have taken place. The lexical rules are thus seen as cyclic, while the post-lexical rules are described as non-cyclic (Halle 1986). Whether a given affix is added in the cyclic or non-cyclic block is seen as "an idiosyncratic property of the affix" (Halle 1986). Some examples of cyclic and non-cyclic English morphological affixes and phonological rules are illustrated in Halle (1986) and reproduced here for convenience:

(1)

- i. Cyclic Block: morphology: affix -ent, -al, -ity...  
phonology: stress rules...
- ii. Non-cyclic block: morphology: affix -hood, -ness, -ed..  
phonology: l-velarization...

Thus, in a word like <equality> stress rules will apply once to <equal> and once again to <equality> as in (2) below:<sup>1</sup>

(2)

STEP 1                    (<al> is cyclic so cyclic rules can apply)

<equal>                    stress rule->    <e'qual>

STEP 2                    (<ity> is cyclic so cyclic rules can apply)

<e'qual+ity>                    stress rule->    <equal'ity>

STEP 3

<equal'ity>

DERIVATION COMPLETE SO NON-CYCLIC RULES CAN APPLY

A well-known problem of this approach is that no external motivation is given for the categories into which the various affixes are put and which have been shown (Fabb 1988<sup>2</sup>, Halle 1986) to have no justification in the morphology itself.

The evidence in support of the Lexical Phonology theory has been based on analyses within the framework. Kaye (1992) has shown that at least three analyses which LP could deal with are possible without recourse to the various mechanisms of the lexical approach. This thesis will continue in that spirit, showing that a more restricted framework is able to deal with a wide and varied selection of phonological events without recourse to such devices as rules, rule ordering and level ordering. I make the assumption that if a number of analyses involving a reasonably rich array of data do not require any

---

<sup>1</sup> Note that this rule is destructive, with the initial stress assignment being completely wiped out in later cycles. This is in diametric opposition to the notion of cyclicity discussed and employed within this thesis.

<sup>2</sup>One of the most frequently stated arguments (Siegel 1974) given in support of level ordering as a theoretical device is that it correctly predicts several non-occurring affix pairs in English. Fabb (1986) gives evidence to show that this is not the case.

mechanisms approaching the complexity of those outlined for LP, it is reasonable to suppose that no language requires them. It is not to be expected that languages will differ along a level-ordering/non-level ordering dimension. It goes without saying that a complete demonstration of the superfluity of the mechanisms of LP would require a re-analysis of every proposed LP analysis in the literature. It is equally obvious that such a demonstration would go far beyond the scope of this thesis. The fact that the three detailed analyses offered in this thesis make no appeal to such mechanisms constitutes a plausibility argument that the additional mechanisms of LP play no role in phonological systems.

### 0.1.3 GOVERNMENT PHONOLOGY; a return to the null hypothesis

A consideration of the phonological visibility of morphology is really a study of two issues:

- (1) In what way does morphology interact with phonology?
- (2) Is this interaction uniform for all forms of affixation?

The position expounded in this thesis is closer to the null hypothesis in that I state that the only contribution which morphology makes to phonology lies in the setting up of domains and that devices such as ordered strata are superfluous. Structuralists claim that there is no difference between complex and simple forms. In keeping with their position, I take the view that this is true for certain kinds of morphology.

Let us consider some English derivational morphology, and contrast the behaviour of the suffix <ity> with that of <ness>. The meaning of both suffixes is similar but the effect of adding each of them is markedly different.

The <ity> suffix when added creates a form which is indistinguishable from an unanalyzable word. Explicitly, the same phonotactic constraints operate within an <ity> form as within a simple word. On the other hand the <ness> suffix in, for example, <goodness> results in a 'dn' sequence which could not be found in a simple form, i.e. there would be no English form like "fedna" where no internal morphological structure exists. Explicitly, the suffix <ness> can be preceded by ANY consonant found at the end of an adjective while the only consonants that can precede "n" within words are "r" and "l" as illustrated orthographically in (3) below:



(3)

ADJECTIVE + NESS	Cn SEQUENCES WORD INTERNALLY
<b>glibness</b>	
<b>tiredness</b>	
<b>roughness</b>	
<b>vagueness</b>	
<b>blackness</b>	
<b>fullness</b>	<b>kiln</b>
<b>dumbness</b>	
<b>suddenness</b>	
<b>wrongness</b>	
<b>dampness</b>	
<b>sureness</b>	<b>warn</b>
<b>crassness</b>	
<b>brashness</b>	
<b>fastness</b>	
<b>suaveness</b>	

The suffix <ity> has an initial nucleus. As there are few constraints within words as to which consonants can occur before a nucleus, a clearer illustration of the position we are adopting will be made by taking a prefix ending with a consonant such as <in>. The prediction which follows from our claims is such that if <in> interacts with the phonology in the same way as <ity> we will find all and only the segments following it which could follow a word-internal "n". As it is clear that any vowel can follow word-internal "n" it will be necessary to look at "n" consonant sequences both within words and across <in> forms. This comparison is shown in (4) where the nasal assimilates to the following consonant in all forms marked by \*:

(4)

Word-internal SEQUENCES	'in' + ADJECTIVE SEQUENCES
limbo*	imbalance*
sink*	incomplete*
cinder	independent
infant	infidelity
finger*	ingratitude*
synchrony*	incredible*
simmer*	immobile*
symposium*	impossible*
linseed	insipid
flint	intrepid
convoy	invariant

We can see that identical constraints exist between the <in> forms and simple words. The forms created by affixing <in> are indistinguishable from simple words with no internal morphology. On the other hand the suffix <un> is more akin in behaviour to <ness>. In marked contrast with the <in> forms, no restrictions exist as to which consonants can precede the "n" of <un> when it does not undergo assimilation as shown in (5):

(5)

Word-internal nC SEQUENCES	un + ADJECTIVE
	unbelievable <sup>3</sup>
	unconstructive
band	undying
infant	unfailing
	ungrateful
	unhappy
	unkind
	unloved
	unmitigating
	unprofessional
	unremitting
linseed	unsatisfying
interest	untenable
convoy	unveiled

<sup>3</sup> Note that this analysis does not claim that forms such as "unprediktabil" are impossible; only that a form such as "inprediktabil" would be.

A comparison of <ity> and <ness> and of <un> and <in> leads us inevitably to the conclusion that all morphology does not interact with phonology in the same way. The question then is as to the nature of the difference of the interaction of the two kinds of affixes we have illustrated. Forms with <ity> and <in> leave no phonological trace of their morphological complexity. In terms of their internal structure and constrained phonotactics they are identical to unanalyzable words with no internal morphology while forms with <ness> and <un> leave traces of an internal domain. Summing up, we can state that some morphology, such as <ness> and <un>, is visible to the phonology, while some, such as <ity> and <in>, is not.

I refer to the morphology which is visible to the phonology as Analytic Morphology, while Non-Analytic Morphology will be the term used to describe morphology which creates unanalyzable words (Kaye 1992, Kaye and Vergnaud 1991).<sup>4</sup> A natural question to ask regarding this division is that concerning the nature of the contribution made by visible morphology to the phonology.

#### 0.1.3.1 Domains

This thesis will show that the only contribution which Analytic Morphology makes to the phonology is the creation of word-internal domains. The two ways in which the domains created by the Analytic Morphology have an impact on phonological events are:

1. The Licensing Principle
2. Domain final empty nucleus licensing

---

<sup>4</sup>All forms which display purported rules such as the great vowel shift, velar softening, etc, which would be impossible to capture in Government Phonology, are amongst the forms which this approach sees as Non-Analytic. These so-called rules NEVER show up in forms with Analytic Morphology.

Both of these factors are discussed in some detail in the following chapter but here we shall look at some general effects which result from them. The Licensing Principle states that every domain will have one head. As this head will bear primary stress it follows that every domain will have one main stress. Let us return to our <ness> vs. <ity> example. If we take the form <infinite> we see that it has primary stress on the first nucleus. If we add <ness> this stress remains unchanged so we have [[in'finite]ness], while the addition of <ity> results in the unanalyzable form [infin'ity] with new stress and a single domain.

The effects of domain final licensing are most clearly seen in a form such as English <sixths>, "siksθs". In this word we find a sequence of sounds unique in the English language as a result of the accumulation of licensed final positions. Thus <sixths> has three internal domain final empty nuclei -[[[siks0]θ0]s0] as the result of morphological concatenation.

#### 0.1.4 ANALYTIC vs. NON-ANALYTIC MORPHOLOGY

Having established that morphology interacts with phonology in two ways (visibly or not) one may now pose the question as to what, if any, factors determine which of the two interfaces is employed for any given morphological construction. Halle addresses this question (*mutatis mutandis*) in the LP framework and adopts an extremely pessimistic view.

Following the spirit of Halle (1986) we could take the view that analyticity is:

"an idiosyncratic and variable property of the affix".

This view, however, that there is no expected correlation between analyticity and other aspects of morpho-syntactic structure, seems too pessimistic. In accordance with Kaye (1992), I will take a somewhat more optimistic approach and briefly consider some examples which illustrate it.

The notion of compositionality, that the meaning of a word is predictable from its parts, has some tendency to be related to analyticity. Consider the English word <cupboard>. Originally a cupboard [[cup]board] was a board for cups. The internal domain was lost so that the form in current usage is "kubord" where the "pb" sequence which would be illicit in a simple word becomes "b". This loss of the internal domain corresponds to a loss of compositionality so that a <cupboard> is no longer a 'board for cups'.

Our second example comes from Prunet (1986). In Standard French there is a mini-paradigm illustrated in (6):

(6)

<mon oncle>	"mən ɔ̃kl"	'my uncle'
<ton oncle>	"tən ɔ̃kl"	'your uncle'
<son oncle>	"sən ɔ̃kl"	'its/her/his uncle'

In French, whenever you have a nasal vowel + nasal consonant + vowel sequence, as in the above cases, there must be internal morphology<sup>5</sup>. In Quebec French however the first person possessive is absorbed into the stem so the new stem is <mononcle> and we have the paradigm:

---

<sup>5</sup>This will be discussed further in the following section.

(7)

<mon mononcle>

<ton mononcle>

<son mononcle>

From this paradigm it is clear that the form <mononcle> is not compositional. Both its ability to occur with any possessive form and the fact that the additional <mon> is required to express the first person possessive clearly indicate this. Given that we have stated that the  $\vee$ cv configuration can only occur when there is internal morphology, and given that the non-compositionality of <mononcle> might lead us to expect it was no longer analytic, we would predict that the first vowel of <mononcle> in the paradigm in (7) should not be nasalised. This is exactly what we find:

(8)

"mən mononkl"

"tən mononkl"

"sən mononkl"

The <mononcle> form has no sign of an internal domain and once again a non-compositional form shows itself to be non-analytic.

The examples given above - and many more could be added - show that there is a clear, cross-linguistic tendency to correlate analyticity with compositionality both in compounds and in affixed forms (cf. infiniteness vs. infinity, ~~unreadable~~ vs illegible, and so on). If internal domains provide parsing cues for internal morphological structure, it is reasonable to suppose that this structure is used in computing meaning and, hence, the meaning computed should bear some relation to its constituent parts. Elimination of internal domains is probable when reference to these constituent parts is no longer computationally



useful, i.e. when compositionality is lost and the meaning of the form cannot be computed from the sum of its parts. These facts enable us to avoid the pessimistic view of Halle.

Nevertheless, it can be shown that, at least at times, analyticity or its absence **must** be an idiosyncratic property. The study of English irregular morphology indicates **why** this is so. All irregular verbs are irregular in the direction of analyticity. Specifically, irregular verbal forms have no internal markers such as licensed final empty nuclei. A brief comparison of the verbs <heat> and <hit> shows that <heat> is regular, but <hit> is not. This stipulation follows from nothing specific to either verb. No pattern exists across languages which relates their regularity to their semantics; so we find that, for example, both French <chauffer> 'to heat' and <frapper> 'to hit' are regular. We have stated that all irregular morphology is irregular in the direction of non-analyticity, so an irregular verb will be non-analytic and a regular verb will be analytic. As I have shown that the regular/irregular nature of verbs is an arbitrary lexical property, and that the notion of non-analyticity is directly related to irregularity, it follows that analyticity must also be an arbitrary lexical property.<sup>6</sup>

In a number of West African languages one can find a word stem with an object clitic. In these same languages there is also a vowel harmony. However an arbitrary variation exists between them as to whether or not the object pronoun is within the scope of the harmony. Thus we find that there is no harmony on the object pronoun in Vata, while in Dida there is. It would seem natural to suppose that whether the clitic harmonizes or not will depend on how closely the clitic binds to its stem. However there is absolutely no difference in the syntactic behaviour of those clitics which harmonize and those which do

---

<sup>6</sup> Indeed, morphological irregularity can be seen as a strategy for table lookup rather than computation. We believe that an irregular form is non-complex and so not computable. This is the function of non-analytic morphology in the English cases.

not. Thus the only possible conclusion must be that whether or not the clitic falls within the scope of a domain is an idiosyncratic property of the lexicon.

## 0.2 WHEN DO PROCESSES APPLY ?

Two points related to the Analytic/non-Analytic Government Phonology Distinction (Kaye and Vergnaud 1990) are discussed in this thesis. The first question, on the nature of morphological visibility, is really a question as to the environment of the processes under investigation; explicitly, whether a morphological domain has played some part in the phonological representation of a given form or not. The other question of importance to this thesis is as to when phonological processes occur. The position taken here can be summarized simply as stating that:

(9)

Phonological processes will apply whenever their conditions are met.  
(Kaye 1992)

Such a position is in direct opposition to the lexical view, which requires that rules have their application assigned to a specific stratum in the phonology (lexical, postlexical etc). As I will claim that not only is there no rule ordering but that there is no phonological rule component at all it is necessary for me to consider recent arguments seeking to justify this position. Bromberger and Halle (1989) attempt to provide theory external evidence for rule ordering. The synchronic data presented as justification of their position concerns the rules of tapping and raising in Canadian English, and their application in two distinct dialects referred to as A and B. For convenience the tables showing the application of these processes in Kaye (1990b) have been reproduced in (10) and (11) below:

(10) DIALECT A

	rayt	rayt+er	rayd	rayd+er
Canadian Raising	rëyt	rëyt+er	_____	_____
t-voicing	_____	rëyd+er	_____	_____
output	[rëyt]	[rëydr]	[rayd]	[raydr]

(11) DIALECT B

	rayt	rayt+er	rayd	rayd+er
Canadian Raising	_____	rayd+er	_____	_____
t-voicing	rëyt	rayd+er	_____	_____
output	[rëyt]	[raydr]	[rayd]	[raydr]

Bromberger and Halle (hereafter B & H) claim that the difference between the two outputs can only be justified by presenting a different rule-ordering for each dialect. Raising is present in both dialects but is bled by the earlier application of t-voicing in dialect B resulting in the output form [raydr]. Kaye (1990b) shows however that this data is somewhat suspect. The original description of Dialect B is in Joos (1942), yet by 1973 Chambers (1973:122) concludes that 'dialect B has disappeared'. As Kaye points out the 'public school children', who were said to be speakers of Dialect B in 1942, must all have 'died prematurely' if there were no remaining speakers by 1973. The data which are presented as a supposedly atheoretical justification for the necessity of rule-ordering are from an extinct dialect whose original existence is questionable.

The second argument which B & H use to justify their position is based on diachronic evidence: the occurrence of Grimm's Law. They begin by presenting the first stage of Grimm's Law as a rule whereby:

(12)

$p \rightarrow f \quad t \rightarrow \theta \quad k \rightarrow x$

They represent this as shown in (13):

(13)

#### GRIMM'S LAW

-continuant

$\rightarrow$  [ + continuant] except after obstruent

-voice

B & H claim that "formally this law is indistinguishable from a phonological rule" (p.62), such as the aspiration rule of (14) which shows why {p,t,k} must be aspirated in the forms of (14b), but not (14c):

(14)

-cont.

$\rightarrow$  [ + aspirated] at the beginning of a stressed syllable

-voiced

(b)

pill, till, kill

(c)

spill, still, skill, soapy, naughty

B & H propose that the similarity of the two rules shown above be used as an argument for historical change; to be seen as the result of "the addition of phonological rules to a language" (p.62). This similarity is captured by describing Grimm's law as a rule

in spite of the fact that there are no synchronic alternations to explain why Grimm's Law should be seen as a rule rather than as a context-free event of Proto Germanic. Consider the case of an early Germanic word "pisk" which altered to "fisk" in accordance with Grimm's Law. In the following generations the child is exposed to the form "fisk". There is no reason to assume that the lexical representation of "fisk" begins with a "p", yet such an assumption is crucial if one wishes to posit Grimm's law as a SYNCHRONIC rule of Early Germanic.

Another assumption of B & H is that the aspiration phenomenon discussed is described as a rule. I will contest this assumption in Chapter Two when I consider a similar process in Modern Icelandic.

The B & H article presents a circular argument. It begins by claiming that languages have extrinsically ordered rules (the Canadian examples). If languages have extrinsically ordered rules they must have rules. B & H assume that historical changes enter the grammar as rules, therefore languages have rules; if languages have rules they must have extrinsically ordered rules, and so on.

#### 0.2.1 STRICT CYCLICITY AND DOMAINS

In the previous section we saw that B & H failed to provide any real evidence for rule-ordering. I continue with a more restricted assumption, to wit, that events occur whenever their conditions are met. I have mentioned two areas where the existence of domains interact with this minimalist assumption: the licensing principle and domain final licensing of empty nuclei. I now add a third factor involving domains: the Strict Cyclicity Principle. In order to illustrate the working of strict cyclicity and to provide further evidence

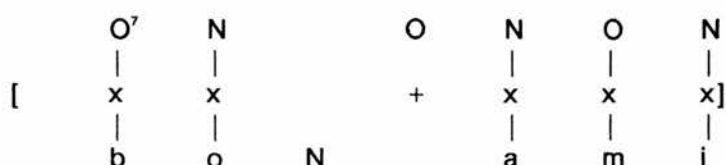
for the superfluity of rules and level ordering, I will discuss Prunet's analysis of French nasalization.

The statement in (9), that processes apply whenever their conditions are met, is also in conflict with another major device of Lexical Phonology, that of level ordering. We will briefly consider here an analysis of French nasalization (Vergnaud 1982, Prunet 1986, Kaye 1992) which depends crucially on the analytic/non-analytic distinction proposed but which needs no level ordering. In the course of this analysis we also consider the notion of Strict Cyclicity in Government Phonology (Kaye & Vergnaud 1990, Kaye 1992) which is crucial both in this French nasalization case and in the Icelandic analysis of Chapter One.

Let us consider two forms from French (Prunet 1986, Kaye 1992): <bon ami> and <son ami>. In isolation both <bon> and <son> are pronounced with a nasalized vowel, "bø" and "sø". The forms <bon ami> and <son ami> differ in so far as only the latter retains the nasalized "o" giving "bonami" but "sø nami".

Following Vergnaud (1982) the liaison consonants are treated as floating segments; that is, as segments not associated to a skeletal point. The <n> in <bon ami> and <son ami> is such a floating segment and the representations in (15) and (16) result:

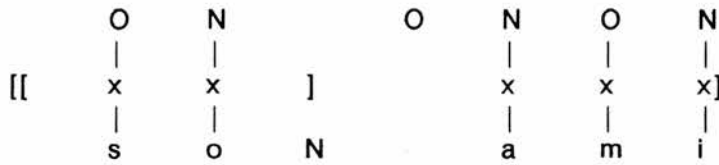
(15)




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<sup>7</sup>In these, and all following diagrams, the following abbreviations are used: O-onset, N-nucleus, R-rime.

(16)



The important difference in the structure is that there is an internal domain in the second form (16)<sup>8</sup>. We shall see that the presence of this domain accounts for the nasal vowel + "n" + oral vowel sequence, while the absence of any domain within the <bonami> form makes it indistinguishable from a simple word. Following Kaye (1992), let us look at the two forms on their innermost cycles:

(17)



In (17a) the second onset, O2, is available to the floating N which docks onto it. In (17b) no such onset is available to the N and it cannot therefore attach itself to anything other than the preceding nucleus, resulting in (18):

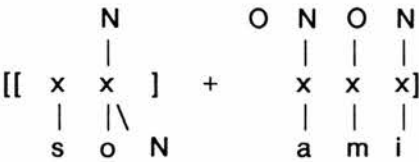
(18)



<sup>8</sup>Prunet also gives syntactic arguments to justify the view that prenominal adjectives are indeed syntactically closer to the head than are possessive pronouns in French. A simple illustration of this is that when both are present, as in a phrase like 'his good friend', the prenominal is closer to the head noun. So we find <son bon ami>, and not \*<bon son ami>.

When we look at <son ami> with both inner and outer domains we see the structure of (19):

(19)



Two factors must be considered at this point. In the innermost domain the N has attached itself to the only available constituent, the preceding nucleus. In the full <son ami> form there is an onset available to the N. It is at this point that we must consider strict cyclicity. The Principle of Strict Cyclicity (PSC)<sup>9</sup> (Chomsky 1973, Kean 1974; Mascaro 1976) has been adopted by Government Phonology as a principle of Universal Grammar. It states that:

(20)

Representations made within an earlier cycle may not be undone.<sup>10</sup>

In <son ami> the innermost domain has the N attached to the nucleus. The PSC prevents this association from being undone. In the new domain however a second association is possible. This also takes place and the N spreads into the following empty onset:

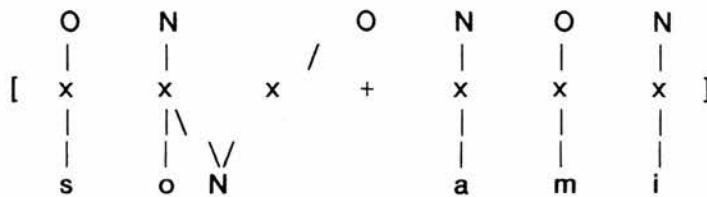
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<sup>9</sup>In Chapter Two an extension of the PSC will be proposed in order to predict the occurrence, and non-occurrence, of h<sup>0</sup> spreading in Icelandic.

<sup>10</sup> The term 'cycle' has been employed here in keeping with the original principle which itself pre-dates Lexical Phonology. To avoid confusion with the implications of the Lexical Phonology use of the terms cyclic and non-cyclic I have chosen for my own part to use throughout, except in this instance, analytic/non-analytic and domain, rather than cyclic, non-cyclic and cycle.



(21)



Crucially in the above example no level ordering is required. The N is linked both to the nucleus of the internal domain and to the onset which became available in the outer domain. Linking has taken place wherever and whenever its conditions were met. The existence of the 'vNv' sequence is the evidence of the internal domain. The <bon ami> form has no such internal domain and therefore such a phonological sequence is impossible.

0.3 SUMMARY

This thesis shows that the strata and level ordering devices of Lexical Phonology are required only as the consequence of a particular way of viewing phonological processes. When phonological events are seen not as rules applying to a given input string on a specified level, but as processes which occur simply because their environmental conditions have been met, an answer much closer to the null hypothesis can be given to our original question: What aspects of morphology are visible to phonology?

## CHAPTER ONE

### A BRIEF INTRODUCTION TO GOVERNMENT PHONOLOGY

#### 1.0 INTRODUCTION

It is only by considering phonological processes in a certain way that we can develop a particular view of the nature of the relationship between phonology and morphology. By adopting the theoretical framework of Government Phonology (GP), we make the initial aim of this thesis possible, and the relationship between morphology and phonology is seen simply as the former contributing domains to the phonological string.

The following analyses are conducted within a phonological framework which is a principle and parameter based theory aiming at explanatory adequacy. The basic concepts of this theory as well as other analyses are presented in Charette 1991, Harris 1990, Kaye 1990, Kaye, Lowenstamm and Vergnaud 1985 & 1990 (henceforth KLV), and Kaye and Vergnaud 1990. For the benefit of readers not familiar with the particular model, this chapter summarizes some aspects of the framework which are fundamental to the present work. For a fuller account and further exemplification the reader is referred to the references cited.

#### 1.1 THE THEORY OF SEGMENTAL REPRESENTATIONS

##### 1.1.1 ELEMENTS

Government Theory provides both a theory of segmental representations and a theory of constituent structure. I shall initially present some of the basic concepts of the first of these.

The basic units of the segmental theory are known as elements. These are autonomous, privative units, each one fully pronounceable in itself. As theoretical primitives they cannot be broken down into smaller units. The elements of the theory and the symbols used to denote them are reproduced in (1, ) below:

ELEMENTS USUALLY ASSOCIATED TO NUCLEI''

(1)

I <sup>0</sup>	FRONTNESS	"i"
U <sup>0</sup>	LABIALITY	"u"
ɹ <sup>+</sup>	ADVANCED TONGUE ROOT	"ɹ"
N <sup>+</sup>	NASALITY	"~"
A <sup>+</sup>	LOWNESS	"a"

ELEMENTS USUALLY ASSOCIATED TO ONSETS

(2)

R <sup>0</sup>	CORONALITY	"r"
? <sup>0</sup>	CONSTRICITION	"?"
V <sup>0</sup>	VELARITY	" "
h <sup>0</sup>	FRICTION	"h"
H <sup>-</sup>	STIFF VOCAL FOLDS	('HIGH TONE')
L <sup>-</sup>	SLACK VOCAL FOLDS	('LOW TONE')

The elements can form complex segments by combining with each other. Combination of elements is done by means of a binary fusion operation known as the element calculus. Within this calculus an element may have one of two possible roles: it

---

''The small superscript to the right of the elements denotes the property of 'charm' associated with each one. The significance of charm will be discussed in the next subsection of this chapter.

may act as the head of an expression or as an operator. An element which is the head of an expression is fully expressed; operators on the other hand may only contribute their salient property. One illustration of this is given by a consideration of the segments "æ" and "ɛ". The "æ" is really a fronted "a", that is to say an  $A^+$  which has been operated on by an  $I^0$ . The "ɛ" on the other hand is really a lowered "i"; or, in GP terms, an  $I^0$  which has been operated on by an  $A^+$ . These two segments and their composition are shown in (3). In keeping with the orthographic conventions of the theory, the head is always the rightmost element of the expression:

(3)

$$"æ" = I^0.A^+$$

$$"ɛ" = A^+.I^0$$

A segment can have numerous operators but never more than one head. For example, the sound "õ" can be written as  $\dagger^+(A^+.U^0)$ ; that is as an "u" which is lowered and tensed. Consonantal representations work in identical fashion; with each segment having minimally a head element, and its operator(s). All of the elements however cannot freely combine with each other. Combinatorial possibilities are restricted by the property of charm.

### 1.1.2 CHARM

To the right of each of the above symbols the reader will have noted a superscript value: 0, +, or -. This denotes the property of charm associated with each element. The concept of charm plays an important part in determining the combinations of elements which are possible as well as the nature (and abilities) of the resulting segment.

Positive charm is associated with resonance; hence the three positively charmed segments,  $A^+$ ,  $N^+$  and  $\dagger^+$ , are those which represent a resonating cavity - the oral, nasal and

pharyngeal cavities respectively. Elements can contribute their charm to expressions depending on their role (head or operator) in the phonological expression, when they act in the role (head or operator) which enables them to do so. The  $A^+$  element contributes its charm to segments in which it is the head. The element  $\downarrow^+$  on the other hand will give its charm to any expression in which it appears. The combinatorial possibilities of the elements are restricted by a constraint which states that:

(4)

Elements of like charm may not combine.

This means that combinations of  $A^+$  and  $\downarrow^+$  where  $A^+$  is the head are universally excluded. By reconsidering our representation of "o":  $\downarrow^+.(A^+.U^0)$  we can have a clear illustration of charm calculation. In the first instance  $A^+$  and  $U^0$  combine.  $U^0$  is the head element,  $A$  is positively charmed but occupies the operator position and so does not contribute its charm to the expression. Thus the overall expression is neutral, giving us  $(A^+.U^0)^0$ . The ATR element then combines with this neutral expression. As we have stated,  $\downarrow$  always contributes its charm value, so this expression now becomes positively charmed, yielding  $((\downarrow^+(A^+.U^0)^0))^+$ .

Consonantal representations differ from vowels in their charm properties as they can be either negatively charmed or neutral. Negative charm is bestowed upon segments by the elements associated with voicing,  $L^-$  and  $H^-$ . In order to understand the nature of these elements it is necessary to consider, in the first instance, the notion of voicing employed within GP theory. The class grouped under [+voice] in Chomsky & Halle (1968) does not constitute a natural class in that it does not characterise the class of segments which undergo a process or those which trigger a process. One example is final devoicing: the set of segments which undergo this are NOT all the so-called voiced segments but only those

which have 'non spontaneous voicing' (Chomsky & Halle 1968). This class of segments, those which have non-spontaneous voicing, are the class of segments which contain the element L'. This L' then represents that class of sounds which is produced with slack vocal folds and often a local lowering of F0. An example of a sound containing L' could be any of the French voiced stops which in contrast with English 'voiced stops' have full voicing throughout their closure period.

Sounds which include the element H' on the other hand are sounds which are produced with tense vocal folds, such as the tense voiceless stops of Korean. Segments which contain neither the H' nor the L' element are neutrally charmed. The inventory of neutral stops includes such sounds as the English voiced stop series or Korean neutral stops. The loss of H' and the consequent loss of charm are important factors in the process of Finnish consonant gradation discussed in Chapter Three.

### 1.1.3 OBLIGATORY CONTOUR PRINCIPLE

The final principle of segmental representations considered here is the GP application of the Obligatory Contour Principle (henceforth the OCP) (Leben 1973) which constrains the nature of the segmental content of adjacent skeletal slots:

(5)

On a given level of structure there can be no two adjacent identical objects.

When two identical objects are adjacent, for example as the result of the concatenation of morphemes, there are two possible outcomes:

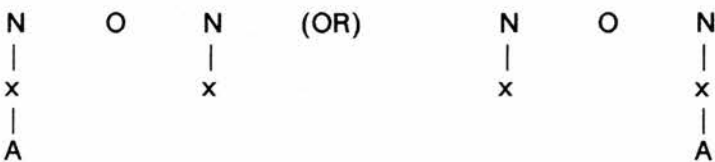
1. A single expression becomes associated to two points as in (6) where the segment A becomes linked to two nuclei:

(6)



2. One of the points remains empty as in (7):

(7)



This notion can be extended to elements so that two points with the same element share an element rather than each having an autonomous one. In Chapter Three we consider the nature of parametric applications of the OCP, and how the degree of similarity tolerated between adjacent segments is subject to parametric variation.

### 1.2 THE THEORY OF CONSTITUENT STRUCTURE

A theory of segmental representations is only one part of an integrated theory. The next task of any framework is to consider the nature of the structure onto which segments are mapped. KLV (1990) presents a theory of constituent structure to interact with the theory of elements which we summarize here.

Consider a tier of x slot units where x is equivalent to a unit of significant time. A single consonant will occupy one such x slot, a geminate will occupy two, a short vowel will occupy one such position and a long vowel two. The phonological string is a sequence of such units. Phonology (given the initial assumptions of the theory employed in this thesis) is the study of how these units interact with each other (given their respective positions in the string) and the way that the segments are realised as a result of these interactions. What constitutes a well formed phonological string can be seen from the application of the licensing principle.

#### 1.2.1 LICENSING

All units of the phonological string are always subject to the licensing principle (Kaye 91:306):

(8)

All phonological positions save one must be licensed within a domain. The unlicensed position is the head of this domain.

Licensing is a binary, asymmetric relation between skeletal points. It has many manifestations but one crucial form of licensing is that of government.

##### 1.2.1.1 Government

Government is one form of licensing. In order for there to be government between two positions at the 'P0' level, (projection zero level, the level at which all positions are present), certain conditions must be satisfied. These conditions are those of Strict Adjacency and Strict Directionality:



(9)

**STRICT ADJACENCY:**

The positions which could enter into the relationship must be adjacent at P0 level.

**STRICT DIRECTIONALITY:**

Directionality of government at the skeletal level is universal, not parameterized as in syntax.

Two types of government result from the conditions in (9):

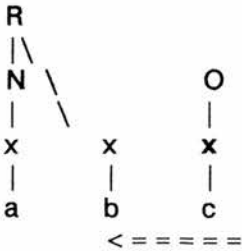
Government within constituents, which is left to right (head initial); and Government between constituents, which is right to left (head final).

(10)

(a) CONSTITUENT GOVERNMENT



(b) INTERCONSTITUENT GOVERNMENT

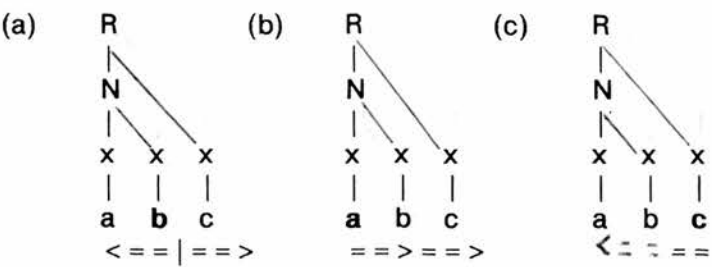


Government Theory has three constituents: Onset, Nucleus and Rime. The rime and nucleus are not independent constituents; rather, the rime may be viewed as a projection of the nucleus, i.e. N<sup>i</sup> in syntactic terms. By applying the conditions on government we can derive the result that these constituents must be maximally binary:

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<sup>12</sup> Throughout this thesis governors will be highlighted in bold where this benefits clarity of exposition.

(11)



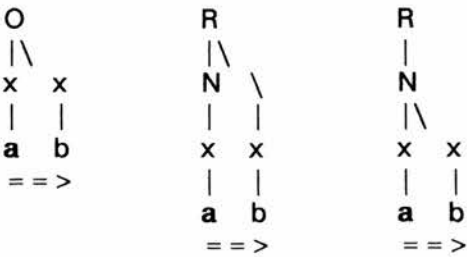
In (11a) point b, if a governor, would have to govern simultaneously in two directions.

In (11b) point a, if a governor, would not be strictly adjacent to point c and would thus be unable to 'see' it.

In (11c) point c, if a governor, would have to govern from right to left **within** a constituent, and would not be adjacent to point a.

Thus we derive the three binary constituents of (12) with their governing relations as shown:

(12)



We have considered a theory of segmental representation and a theory of constituent structure indicating how the phonological string is organised. We now look at how segmental representation and constituent structure relate to each other.

### 1.3 THE INTERFACE BETWEEN PHONOLOGICAL EXPRESSIONS AND CONSTITUENT STRUCTURE

In order for a given segment to act as a governor there are certain segmental requirements which must be fulfilled by it. Within constituents governors must be charmed. Governed members of nuclei must not only be charmless but simplex<sup>13</sup>. This produces a basic asymmetry so that if X1X2 is a well formed constituent sequence X2X1 cannot be. A negatively charmed, voiceless "P" can act as an onset head. The segment "r °" is neutral and simplex. Together these two segments can form the branching onset "pr". The sequence "rp" on the other hand could not form a branching onset because:

- (1) the head of a constituent is always initial and must be charmed; r is neutral, and
- (2) the governed member of a branching onset must be neutral and simplex; p is neither.

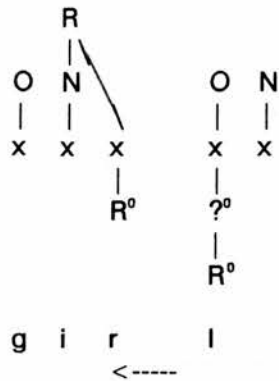
Government between constituents occurs as the fulfilment of slightly different segmental conditions. When we have a branching rime followed by an onset we have inter-constituent government with the onset acting as governor to the rimal branch. The segmental requirements of the governor in such cases are different, because the segmental requirements for a governor within a constituent are more stringent than those which operate on an interconstituent governor. We find that an interconstituent governor does not necessarily have to be charmed if it has a complexity greater than its governee (where complexity is a number defined according to the number of elements present in any given segmental representation, as shown in (13)) while a governee cannot be charmed.

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<sup>13</sup> As will be seen in our discussion of Icelandic branching onsets this stipulation is generally true of the governed members of branching onsets too. The segment 'l' however is somewhat exceptional with regard to this stipulation as it can be the recessive member of a branching onset in forms such as English <plan> despite the fact that it is not simplex in underlying form. We shall see in Chapter Two that such <pl> onsets are frequently unstable.

(13)

<girl>

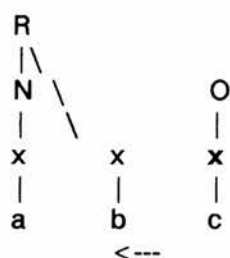


We have seen that a phonological string is not merely a sequence of well-formed Onset-Nucleus pairs. Transconstituent government shows that these constituents need to be bound together. The binding agent is government. The next principle to be discussed shows additional ways in which constituents depend on each other.

### 1.3.1 CODA LICENSING PRINCIPLE

In (8) we stated that all positions in a string except the head have to be licensed. Furthermore Kaye (1990) shows that positions governed by an interconstituent governor (i.e. rimal complements) are licensed by that governor. In (14) position b is both licensed and governed by position c.

(14)



Formally stated, this is the Coda Licensing Principle (Kaye 1990:311):

(15)

**CODA LICENSING PRINCIPLE:**

Rimal positions must be licensed by a following onset.

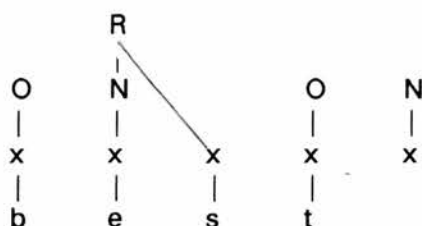
From this principle we see that a form such as English <back> "bak" must be syllabified as in (16):

(16)



The word <back> consists of two open syllables with no final onset to license the "k" into a branching rime unlike a form such as <best> in (17):

(17)



In both these examples the pseudo-final onset is licensed by a following nucleus which is empty. Coda licensing excludes domain final consonants. It follows that all domains end in a nucleus. If both <back> "bak0" and <best> "best0" end in a nucleus we must look at the nature of this nucleus and the reasons for its inaudibility. This brings us to a consideration of phonological empty categories.

### 1.3.2 EMPTY CATEGORIES IN PHONOLOGY

From the previous section we can see that GP must assume a final nucleus, which at times appears to have no phonetic content, for each domain. Let us call an "empty nucleus" a structure of the form:



where no phonological material is associated to the nuclear position. Empty categories follow as a logical consequence of phonological nonlinearity. Given the existence of a skeleton we must assume that one-many and many-one relations exist between skeletal points and segmental material. Empty positions will occur wherever the number of points

is greater than the amount of segmental material available to occupy them. In order to indicate how these empty categories are to be interpreted GP sets up the Empty Category Principle (ECP):

(18)

A licensed empty nucleus has no phonetic content.

There are basically two different kinds of languages: those such as English and Icelandic where the full set of consonants in the language can occur in an apparently word final position, and languages where such final onsets are either absent, as Kikuyu, or severely restricted, such as Finnish. We stated that all onsets must be licensed by a following nucleus. Languages which have final consonants must have final empty nuclei licensing them. The question remains as to what licenses a position to be empty. We find that the two different kinds of languages discussed above can be divided according to the following parameter:

(19)

Languages may or may not license domain final empty nuclei.

A language such as Kikuyu does not have final empty nuclei licensing. This means that a form such as "bak" in (16) would be illicit in Kikuyu where no final empty position would be licensed, so that it could, in turn, license a preceding onset. In English, which does license such final empty nuclei, such a form is perfectly well formed so that we find pseudo word-final onsets in abundance.

Kaye (1990) successfully demonstrates that the presence or absence of these word-final consonants is independent of whether or not a language has closed syllables. The fact that "bak" is illicit in Kikuyu is not because Kikuyu has no closed syllables; the form "bak" would be equally illicit in Italian where closed syllables are in evidence in forms such as <gente> 'people'. Rather "bak" is illicit in Kikuyu because Kikuyu does not license final empty nuclei.

### 1.3.3 PROPER GOVERNMENT

The ECP relies on licensing, one form of which is domain final licensing (and another, licensing by proper government, etc). The Principle of Proper Government states that:

(20)

A properly governs B iff:

- I. A is adjacent to B on some level of projection.
- II. A is not itself licensed.
- III. No governing domain separates A from B.

The following data and structures (from Kaye 1990), displaying vowel/zero alternations, illustrate the application of proper government in Moroccan Arabic. Consider (21):



(21)

"kitbu:" 'they write'

O	N1	O	N2	O	N3
					\
x	x	x	x	x	xx
					/
k		t		b	u

The empty position of N2 is properly governed by the following nucleus N3. No other nucleus intervenes between N2 and N3 (which are therefore adjacent at the level of nuclear projection), N3 is not itself licensed, and no governing domain separates the two nuclei. N2 however as a licensed empty category cannot govern N1 which must be realised, so that the resulting form is "kitbu".

1.3.4 DOUBLY-LINKED SEGMENTS

The third case of licensing to be considered here is that of a position which is licensed because it is contained within a doubly linked segment. The Moroccan Arabic <hall> 'open' occupies the same template as the trilateral <ktb> and is syllabified accordingly as in (22) (Kaye 1990):

(22)

O	N1	O	N2	O	N3
x	x	x	x	x	x
h	a	\	l	/	

N2 is an empty nucleus. N3 cannot be properly governing it because it is itself a licensed position. In fact the position N2 is licensed only because it is contained within the governing domain which exists between any doubly-linked segment. This case of licensing is extended to include other governing domains between two onsets in the Icelandic analysis of Chapter Two.

#### 1.4 SUMMARY

In summary, we have seen that a licensed position has no phonetic content and that a segment is licensed, if:

1. It is a licensed final empty nucleus in a language which has as a parameter the licensing of final empty nuclear positions.
2. It is properly governed.
3. It is contained within the governing domain of two onsets.

Each form of licensing plays a crucial part in the analyses of the next three chapters. Domain final licensing of nuclei is an essential factor in the phonology of complex forms. Proper government is a major feature of Finnish consonant gradation, and domain-internal licensing plays an important part in a consideration of the environment of Icelandic aspiration.

CHAPTER TWO  
ICELANDIC ASPIRATION

2.0 INTRODUCTION

This chapter presents an analysis of the Modern Icelandic aspiration process which goes some way towards substantiating our claim as to the nature of the phonology/morphology interface. Many of the devices employed in other theories such as rules, level ordering and scansion techniques are shown to be no more than the consequences of a particular way of viewing phonological events. When phonological events are seen as processes, such devices are no longer necessary to account for their occurrence.

The notions of cyclicity discussed in the Introduction are shown to be inadequate to deal with metrically created points whose behaviour is central to an understanding of Modern Icelandic aspiration. A constraint on spreading - The Cyclic Spreading Constraint - is proposed to account for the restrictive spreading of non-nuclear segments. This constraint explains cases in Icelandic where there is an alternation between a long vowel and a segment.

In my consideration of the various aspiration processes, as they occur in certain dialects of Modern Icelandic, I begin by briefly examining the data as it has been presented in the cited works and verified in consultation with a native speaker. This section is followed by a critical summary of some of the previous analyses of the phenomena and concludes with an analysis in the theoretical framework of Charm and Government as summarized in Chapter One.



Both post and pre-aspiration are frequently occurring phenomena in the so-called 'hard' dialects of Icelandic. This analysis deals with the apparently problematic distributions of both processes in a unified and explanatory manner.

## 2.1 THE PHENOMENA

Let us consider the data (Haugen (1958), Thrainsson (1978)).<sup>14</sup> There are two series of stops in Icelandic, usually labelled hard and soft. In keeping with the normal practice they are transcribed in this thesis as "p,t,k," and "b,d,g", respectively although both series are voiceless in all environments (Haugen 1958, Thrainsson 1978). The first series aspirates in initial position for all dialects of Icelandic. Intervocally and between a vowel and "j,v,r" there is a difference between dialects. In this position, in the soft, mainly Southern, speech (linmaeli) only the "b,d,g," type stops occur and in the hard Northern dialects (hardmaeli) only the aspirated "p,t,k," occur.

(1)

"P <sup>h</sup> i:p <sup>h</sup> a"	(pipe, hardmaeli realisation)
"p <sup>h</sup> i:ba"	(pipe, linmaeli realisation)
"de:k <sup>h</sup> ra"	(to pamper, hardmaeli realisation)
"de:gra"	(to pamper, linmaeli realisation)

De-aspiration of the hard stop occurs when it follows an "s", as is the case in English.

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<sup>14</sup>Some of the data herein presented were also suggested to me by my helpful and patient informant, Sigridur Oladottir.

(2)

English	"p <sup>h</sup> ai" vs. "spai", or, "t <sup>h</sup> ul" vs. "stul"
Icelandic	"t <sup>h</sup> i:tra" 'to shiver' vs. "standa" 'to stand'

Within certain Northern dialects a hard stop in a medial position following a liquid, nasal or voiced fricative causes the preceding segment to devoice while it itself becomes de-aspirated as in (3):

(3)

"fíntan" 'fifteen' "heilt" 'whole' (neuter)

#### 2.1.1 Pre-aspiration of Gemimates

In other environments, within all dialects, the "p,t,k" series pre-aspirates, loses its post-aspiration, and is preceded by a short vowel. When the "p,t,k" is lexically geminate (as in <kappi> 'hero' <brattur> 'steep' and <bekkur> 'bench') or when a geminate is created as the result of affixation (Thrainsson 1978), pre-aspiration occurs:

(4)

"ka<sup>h</sup>pi" "bra<sup>h</sup>tur" "be<sup>h</sup>kur"

(5)

<feit>	"fei:t"	'fat'	(fem.sg.)
<feitt>	"feiht"	'fat'	(neut.sg.)

In Icelandic a geminate may also be formed as the result of an assimilatory process. The past tense morpheme <th>, becomes "t" when the stem to which it is added ends in "s", "p", "k" or "t".

(6)

<leys thu>	'you untie'	"leystu"
<glap thu>	'you stare'	"glaptu"
<vak thu>	'you wake'	"vaktu"

By adding the enclitic <thu> to a stem already ending in <t> we create a geminate <tt>. Such forms display pre-aspiration as shown in (7). (See Thrainsson 1978 for further details).

(7)

<maet thu>	'meet you'	"maehtu"
<nyt thu>	'utilize you'	"nyhtu"

## 2.1.2 {P,T,K} + {L,M,N} Pre-aspiration

When the hard stop is immediately followed by a member of the set [l,m,n] pre-aspiration is also apparent:

(8)

'epli'	"e <sup>h</sup> pli"	(apple)
'vakna'	"va <sup>h</sup> kna"	(wake up)
'ritmi'	"ri <sup>h</sup> tmi"	(rhythm)

Once again the process occurs regardless of how the environment is created (Thrainsson 1978). When the environment is created as the result of adding the genitive marker <na>, we find forms such as those in (9), while (10) illustrates cases where syncope has created the {ptk} + {lmn} sequence.

(9)

Nom. Singular		Gen. Plural
<pipa>	'pipe'	"p <sup>h</sup> i:p <sup>h</sup> a"
<gata>	'street'	"ga:t <sup>h</sup> a"
<kaka>	'cake'	"k <sup>h</sup> a:k <sup>h</sup> a"
		<pipna> "p <sup>h</sup> i <sup>h</sup> pna"
		<gatna> "gahtna"
		<kakna> "k <sup>h</sup> ahkna"

(10)

Nom. Singular			Dative Singular	
<depill>	'dot'	"dep <sup>h</sup> ill"	<depli>	"dehpli"
<bitil>	'Beatle' <sup>15</sup>	"bi:t <sup>h</sup> il"	<bitli>	"bihtli"

In each of these cases, as in those where the stops are geminate, the vowel preceding the stop and its pre-aspiration is short. If we take the view that the pre-aspiration

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<sup>15</sup>A member of the pop group well known in the sixties. This example shows that the process is indeed an active synchronic one.

segment has segmental duration, the preceding short vowel is an indication of the restrictions on what constitutes a well formed Icelandic syllable.

2.1.3 {P,T,K} + {J,V,R} DATA

Stripped as far as possible of interpretational variations, the facts are that in stressed syllables Icelandic has a long vowel when one or no consonant follows and a short vowel before two or more. The well-known exceptions to this are the clusters consisting of {p,t,k,s} followed by {j,v,r} where the preceding vowel is always long as shown in (11):

(11)

'titra'	"tʰi:tʰra"	(to shiver)
'vekja'	"ve:kʰja"	(to awaken)
'depra'	"de:pʰra"	(sadness)
'liprir'	"li:pʰrir"	(nimble)
'tvisvar'	"tvi:svar"	(twice)

Thus the following constitute well formed sequences in Modern Icelandic: CV:##, CV:C, CVCC. Forms such as CV:CC, CVC and CV## are illicit, with the exception of the examples given in (11).

2.1.4 SUMMARY

In this chapter I present an analysis which shows the nature of pre-aspiration and post-aspiration. I consider why the phenomena are peculiar to the stops {p,t,k} and what it is about their underlying representation that makes the occurrence of the process predictable. I look at the nature of the environment in which the process occurs, both in terms of constituent structure and in terms of the underlying representation of adjacent



segments, and I show how a consideration of these factors enables the apparently anomalous behaviour of 'exceptional' cases to be viewed as predictable and regular. I begin by looking at some previous analyses of Icelandic aspiration.

## 2.2 PREVIOUS ANALYSES

### 2.2.1 THRAINSSON

Thrainsson's (1978) study is an attempt to understand the nature of the aspiration process. His autosegmental treatment details the loss of the feature [spread glottis] from the hard consonant and its resulting presence in the representation of the preceding vowel. Hard stops are the trigger of pre-aspiration because they are the segments which have the feature in their underlying representation in the environment where it can occur. The distinctiveness of the feature [spread glottis] is seen as the reason why it (rather than any other feature) spreads. Thrainsson relates the distinctiveness of [+spread glottis] to the occurrence of the rule of pre-aspiration, making preliminary forays into other pre-aspirating languages in his appendix to see if this hypothesis bears scrutiny.

The universal implication of this idea, that a feature spreads if, and only if, it is distinctive, was successfully refuted by Halle (1959) where he demonstrated that all Russian 'voiced' stops would devoice regardless of whether they were in contrast with voiceless equivalents or not. Further support for Halle can be found in a brief consideration of Pulaar where an ATR vowel harmony is triggered by four of its seven vowels. Of these four triggers however there are two, I and U, which have no [-ATR] counterparts (Sylla 1982).

The Thrainsson analysis uses language-specific rules to convert "p,t,k," to geminate "pp,tt,kk" when they occur before "l,m,n" without offering an explanation as to why this

should be the case. Pre-aspiration is seen as being caused by the presence of a geminate hard stop. In order to derive this environment in cases where there are no lexical geminates Thrainsson employs rules to create it (see Arnason 1986:13 for a brief discussion of this). The pre-aspiration results from a lengthening of the stop. This lengthening occurs when a member of the set [p,t,k] is followed by [l,m,n]. No explanation is given as to why this should happen. No particular claims are made about the nature of l,m,n as opposed to any other segment to indicate why they should cause preceding stops to lengthen.

The experimental work of Garnes (1974) is used to show that the measurements of the length of the stop and its aspiration segment in words like <hittni> "hihtni" 'marksmanship' (where there is what Thrainsson describes as a lexical geminate) is not significantly different from that of <vatna> "vahtna" 'to water' where the stop is lexically short. Thrainsson claims that the similarity in length is due to the lengthening of the simple stop. This lengthening is said to occur as the result of the presence of the following {l,m,n}. The duration of pre-aspiration plus stop in underlying geminate cases without a following {l,m,n,} (e.g. <settra> "sehtra" (placed)) is also shown to be consistent with the stop in forms like <vatna> and <hittni>. The similar duration of the pre-aspiration segment plus stop in all three cases is used by Thrainsson as evidence in support of his claim that simple stops preceding l,m,n are lengthened. This is a possible interpretation. It is also possible, however, to claim that all p,t,k, in Icelandic have the segmental duration of geminates except when followed by a nucleus or j,v,r. Thus the "t" in an example like <setra> (residences) could be underlyingly "settra" but would be converted to "se:tra" because the "t" is followed by an "r". There is no convincing argumentation as to the nature of the change undergone by the segment; that is to say whether the process is one which involves the lengthening of p,t,k, given a certain environment (i.e. that where the stop is followed by {l,m,n}); or the shortening of p,t,k, given a different one (i.e. where the stop is followed immediately by a nucleus or {j,v,r}).

In Thrainsson's analysis, the configuration V C1 C1 (where C1 = p,t or k ) is seen as a vowel followed by two full sets of features, laryngeal and supralaryngeal, for each C.

(12)

Laryngeal features:	<div> <div>- spr gl</div> <div>-constr gl</div> <div>- stiff vf</div> <div>- slack vf</div> </div>	<div> <div>+ spr gl</div> <div>- constr gl</div> <div>+ stiff vf</div> <div>- slack vf</div> </div>	<div> <div>+ spr gl</div> <div>- constr gl</div> <div>+ stiff vf</div> <div>- slack vf</div> </div>
Segments	V	C1	C1
Supra-laryngeal features	<div> <div>+/-high</div> <div>+/-back</div> <div>.</div> <div>.</div> <div>.</div> </div>	<div> <div>- son</div> <div>- cont</div> <div>X lab</div> <div>Y cor</div> <div>Z high</div> <div>  </div> <div>V</div> <div>Ø</div> </div>	<div> <div>-son</div> <div>-cont</div> <div>X lab</div> <div>Y cor</div> <div>Z high</div> </div>

In the analysis the supralaryngeal features in position C1 are deleted by a rule (with no particular account as to why they should be) so that what is left is the laryngeal feature specification, which is that of the segment "h". No specific reason is given to explain why the supralaryngeal, rather than the laryngeal, features are deleted during the process.

### 2.2.2 ARNASON

Arnason (1986) tackles the Icelandic data with a rule-based solution. In the course of his discussion two rules are presented:

(13)

V ----> [- long]/\_\_c2

(14)

-sonorant

-continuant ----> [+ spread glottis]

+spread glottis

- sonorant / vowel (x)\_\_\_  
- continuant / (- long)

In the case of (13) Arnason himself states that a rule lengthening vowels before a single consonant would be equally correct. Like Thrainsson, Arnason makes no attempt to say why any given segment triggers the process in question. There is no explanation as to why the vowel should shorten before two consonants rather than before three or before a nasal, etc. This shortcoming of the analysis is one which lies firmly rooted in any rule-based description. A system which provides one with a means of describing 'difficult' distributions will only be meritorious if it is incapable of expressing impossible ones. Arnason preempts such attacks on his theoretical stance by claiming that the "old-fashioned rules" shown above are necessary to account for Icelandic distribution - a feat which he sees as being beyond the ability of "non-linear formalism" (Arnason 1986;21).

Arnason, unlike Thrainsson, does acknowledge the need for a cv tier to account for what he describes as 'its [pre-aspiration's] participation in the rhythmic structure of the spoken language today' (Arnason 1986:19). No attempt is made however to reconcile this structure with his proposed feature representation. Both Thrainsson and Arnason concentrate on the movement of underlying representations and the environment where these movements occur. Both analyses had shown how the pieces had moved, and to where, but neither had made clear the layout of the board.

2.2.3 MURRAY AND VENNEMAN

The other analyses of Icelandic to be considered here are those of Vennemann (1972), Murray and Venneman (1983) and Iverson and Kesterson (1989). Although these papers do not really concern themselves with the pre-aspiration debate, their proposed syllable structures present certain logical consequences for the phenomenon under discussion.

Venneman (1972) considers the nature of Icelandic vowel lengthening in the light of a proposed syllable structure. The prohibition of word initial light syllables in Modern Icelandic results in an open syllable lengthening rule. The "p,t,k,s," followed by "j,v,r" cases are syllabified as branching onsets following open syllables so that the length of the preceding vowel in such cases is seen as unexceptional.

This analysis is still plagued by the problems of rule-based analyses discussed previously. Nothing is said which suggests why vowels should lengthen in open syllables, rather than shorten in closed ones. Murray and Venneman (1983) both defend Venneman's analysis against Arnason's criticisms (Arnason 1986) and add to it by presenting a language-specific rule which states the set of consonants able to form an onset when the preceding syllable has a strong coda. This rule works by assigning numerical values to segments to form a hierarchy of strength and then by stating which values are allowed to occur in given positions. The following scale is assumed for Icelandic:

(15)

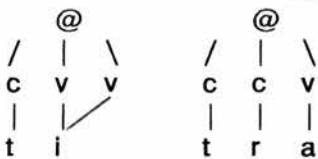
Glides 1	/r/ 2	/l/ 3	nasals 4	voiced fricatives 5
voiced stops 6		voiceless fricatives 7		voiceless stops 8

A condition is said to operate in Icelandic such that if a segment which closes a syllable is strong, (that is, has a hierarchy value equal to or greater than 7), then the syllable which follows must have an initial onset with a value greater than 2. Thus the "p" in <depra> 'sadness', as a voiceless stop, must have a value of 8. In order to close a syllable it must be followed by a segment with a value greater than 2. The following "r" has a value of 2, and no more. This means that "p" is unable to close the first syllable because "r" is not strong enough to open the following one. A long vowel then must close the first syllable while "pr" forms the initial branching onset of the second. In a form such as <gulra> the "r" is able to open the second syllable on its own as the preceding segment "l" has a value of only 3.

Some of the results of this notion of a strength hierarchy are consistent with my analysis. Restrictions of Government, it will be seen, allow only certain consonants to license the rimal complements which occur in Modern Icelandic. The Venneman analysis however has certain implications for the pre-aspiration cases which make it flawed.

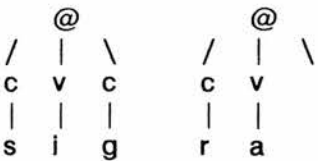
Venneman's analysis presents the following structure for the word "titra" 'to shiver':-

(16)



as opposed to that shown in (17) for "sigra" 'victory':

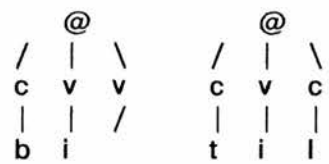
(17)



With this in mind it is interesting to consider the cases where pre-aspiration occurs as the result of "p,t,k" followed by "l,m,n". The form "bitil" 'beadle' becomes "bihtli" in the dative

singular as the result of syncope creating the pre-aspiration environment. The first form "bi:til" would suggest (following the previous analyses) the syllabic structure shown in (18):

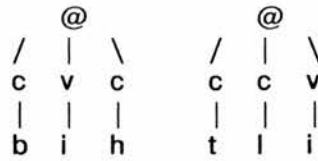
(18)



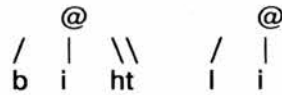
In the dative singular form the vowel presumably shortens because the syllable is deemed to be closed. If the vowel shortening is considered in isolation, without reference to the aspiration phenomenon, we would expect a structure which came out as <bit#li> after the application of the syncope rule. Firstly, the consonant "l" does have a hierarchy value which is greater than '2' (in fact it has a value of 3) and it is able to open the second syllable. Secondly, the shortening of the vowel suggests, according to the analysis, that the first syllable is closed by the stop. As we know from the introduction to the phenomena, this is not the case. In cases where the 'hard' stops are followed by "l,m,n" pre-aspiration occurs so that the "h" occupies the point formerly filled by the vowel.

This presents two logical possibilities for the structure of the form:

(19)



(20)



The example shown in (19) is apparently illicit as it contains a branching onset 'tl' which is not found word initially in Icelandic syllables (Haugen 1958). It also appears to violate the consonantal strength conditions laid down in Murray and Venneman (1983:524) where the process shown in (21) can only be fulfilled for Icelandic within conditions such that  $a > 7, b < 2$ .

(21)

$$-VA_{\#}B_{\#}V \rightarrow -V\#A_{\#}B_{\#}V-$$

Example (20) raises the question as to why there was pre-aspiration at all when an underlying structure of this form should be identical with that of the "gulra" cases where the shortening is permissible. In addition, there is the necessary inclusion of a branching coda, although no prior justification or theoretical explanation is given either for its existence, or for why vowel lengthening should exclude "p,t,k" from occupying it while pre-aspiration does not.

Iverson and Kesterson (1989) highlight another problem of this analysis as being the separate descriptions for mono and polysyllabic forms which result from it. Venneman's



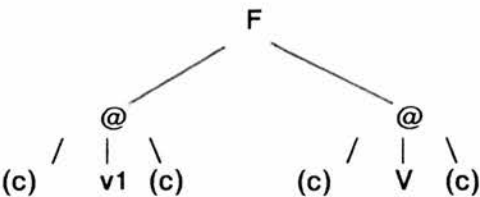
analysis claims that cvc sequences are possible syllable finally in a form such as <gul#ra> but illicit word finally. The constraint which he introduces to prevent cvc# is seen as operational solely on monosyllabic forms although no argumentation is given to support this claim. Further criticisms of Venneman's paper, and details of this latter problem, are to be found in Iverson and Kesterson (1989).

#### 2.2.4 IVERSON AND KESTERSON

This is the most recent of the papers to tackle the Icelandic data. As in the Venneman article, Iverson and Kesterson (henceforth I & K) do not set out to discuss the aspiration process but rather to present a syllabic template within the theory of metrical phonology for the language as a whole, while simultaneously dealing with the vowel-shortening facts. Their treatment enables them to unify rather beautifully the seemingly contradictory patterns presented by many of the previous analyses. The problem is that after drawing up a template it is only the application of a rule (Hyman's Onset Creation Rule (Hyman 1985)) which maps the segments onto the structure. Once again the implications for the "l,m,n" cases of pre-aspiration is unclear.

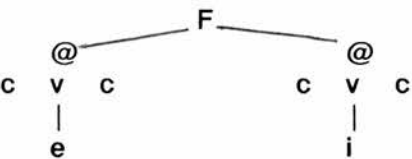
Consider the Iverson & Kesterson template:

(22)



All vowels are assumed to be short in underlying representation. The first vowel is attached to V1 and in monosyllables the second v slot is said to "dominate a null element" (I & K;39). After the association of all vowels, consonants which are adjacent to the vowels of the word (or to the null V unit) are associated with the C element on the skeleton to its left. Presumably a word like "fahtur" is syllabified as <fah#tur>. A word like "fa:t" has a long vowel because the second c in the first foot is unoccupied, leaving an obligatory timing unit empty which the long vowel then fills. This does indeed predict vowel lengthening in all cases, both disyllabic and monosyllabic. There is however the question of the syllabification of words like "dehpli" (dot). According to the analysis we associate vowels to the V timing slots of the Icelandic syllable structure above as shown in (23):

(23)



After vowels have been associated, the consonants adjacent to the vowels are associated to the c time slot to the vowel's left:

(24)



The reader is instructed to "associate post vocalic consonants to the c timing units directly following the v timing elements" (l & K:41):

(25)



This structure is problematic on several accounts. There is no explanation as to why the "p" closes the syllable and has a preceding pre-aspiration segment, nor does there seem to be anything rather than an arbitrary set of rules to prevent a syllabification which maps the "h" onto the end of the final syllable and begins the second syllable with the "pl" cluster. It is also difficult to see how the "h" and the "p" can be shown to be sharing a 'c timing slot' when the segmental nature of the pre-aspiration segment is generally accepted (Thrainsson 1978). If the "h" is to be used to close the first syllable, problematic clusters such as "pn" or "tl", etc will initialise the second syllable in a word like <pipna> (genitive plural, 'pipe') "pihpna" if it is syllabified as <pih#pna>.

### 2.2.5 SUMMARY

The problems of the previous analyses have stemmed from the lack of one of the components essential to a complete account. The autosegmental analysis has no syllable structure on which to map the components of the process. The Iverson and Kesterson analysis, on the other hand, ignores the effects of aspiration while trying to construct a template for a language in which it is a regularly occurring synchronic process. The Murray and Venneman analysis, while accounting for both segmental representation and syllable structure, suffers from the arbitrariness which is a consequence of the rule-based nature of its theoretical approach.

### 2.3 MY ANALYSIS

In the analysis which now follows I hope to redress some of the shortcomings which have been discussed. Contrary to the claims of Arnason (1986;21) a non-linear analysis of Modern Icelandic can account for the distributional facts (as well as offering some explanations) without any recourse to rules. Icelandic aspiration, in common with other phonological processes, is non-arbitrary and occurs within a set of strictly defined principles and parameters. The framework of Government Phonology, although severely constrained in its outlook, can provide a theoretical mechanism which is able to deal with the segmental and syllabic nature of the process in an explanatory way.

A complete analysis is possible only when both underlying representation and syllable structure are considered together. One consequence of this analysis is that apparently 'exceptional' forms are shown to behave in a highly predictable and regular way.

The aim of the analysis is to enable the reader to see why things are the way they are, and to demonstrate a means of expressing them.

Having established two minimum requirements for any analysis - segmental representation and syllable structure - we can see that the theoretical framework of Charm and Government affords two practical advantages to the working linguist. Firstly it provides her with a means of describing the underlying representation of the segments involved in the process and secondly it provides a way of mapping these representations onto syllabic constituents already defined by the principles and parameters of the theory.

Let us consider each of these matters in turn. The privativeness of GP has certain consequences for segmental typology. Phonological representations are interpretable at all levels. They are never incomplete or underspecified. The notion that redundant aspects of segmental structure are not present in lexical representations is rejected by Government Phonology Theory. Segmental representation is seen as universal, with identical theoretical objects receiving identical segmental representations across linguistic systems. Any given property may or may not be present within a particular representation. If it is present it may or may not spread, depending on the environment. Phonological processes represent the loss or gain of elements to the underlying representation. Properties which are not present cannot appear during the course of a derivation. In straightforward terms something which is not there cannot spread.

The second analytic tool, that of structure, is provided by the constituent structure component of the theory as summarized in Chapter One. This is not a language-specific template adapted to fit Icelandic, but a universally defined structure. The theoretical machinery is predefined in accordance with the knowledge that we already have so that we can use it to consider the data in a logical, predictive way. Segmental representation and

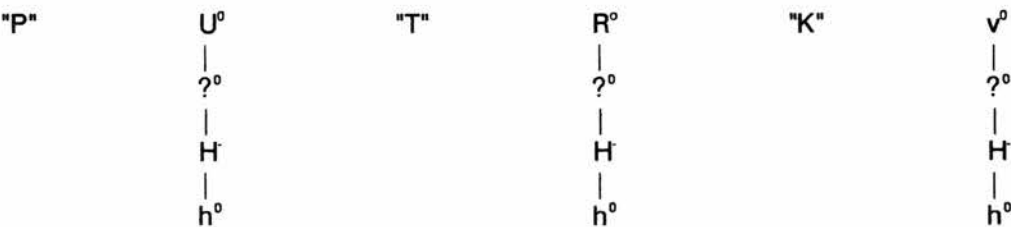
constituent structure are used to analyze the aspiration process (and may be further constrained or refined) and are NOT constructed as a way to describe it.

### 2.3.1 THE SEGMENTAL REPRESENTATION

The first thing to consider is the underlying representation of the Icelandic p,t,k series. The element of most relevance for a consideration of the process of h<sup>0</sup> spreading (aspiration) is h<sup>0</sup> itself and its presence or absence in a given segment.

The h<sup>0</sup> has frication as its salient property, and is presumed to be present in certain stops and in all fricatives. In the former it has the role of operator while in the latter it is the head (see Chapter One). In isolation, the element h<sup>0</sup> is pronounced as in English 'horse' in those dialects where it is manifest (i.e. not "ors"). The segments which trigger aspiration in Icelandic are the stops which include h<sup>0</sup> within their representation. The following diagrams show the representation of Icelandic hard stops.<sup>16</sup>

(26)



<sup>16</sup> For a complete exposition of the nature of these symbols, what they represent and how they combine, the reader is referred to Chapter One and to the references there cited.

This analysis shows that the aspiration processes in Icelandic involve the movement of the friction element from the voiceless stop to an adjacent skeletal point. There is only one element  $h^0$  per stop. I propose to constrain the theory further. In keeping with restrictions of directionality, I will claim that if an element moves in one direction it cannot move in the other. This accounts for the fact that post- and pre-aspiration are mutually exclusive. An element which is moving rightwards (as in post-aspiration) will be unable to move simultaneously to the left.

Some form of aspiration is always present in the Icelandic 'hard' stops. They always post-aspirate, pre-aspirate or have some devoicing or de-aspiration effect on adjacent segments. If we assume that these phenomena are the result of the movement of  $h^0$  we can state that a parameter exists in Icelandic such that the friction element in Icelandic must always spread.

### 2.3.2 THE SYLLABLE STRUCTURE

#### 2.3.2.1 The Branching Rime Constraint

In order to discover where it is that the element is moving to, and why, it will be necessary to define, in the first instance, those environments where different directions of movement take place. In the opening discussion of this paper I presented a statement of what constitutes a well-formed Icelandic stressed syllable. The following templates for well-formed onset and nucleus configurations result.<sup>17</sup>

---

<sup>17</sup>These structures are constructed within the principles of Government Phonology which only permits maximally binary constituents. The result is that the forms presented, and only the forms presented, are possible given the phonotactic constraints of the language.

(27)

CV:

CV:C

CVCC



From these diagrams it is apparent that there is a constraint on Icelandic rimes such that they must branch. We shall refer to this as a Branching Rime Constraint (KLV 1990), henceforth BRC. The application of the BRC on stressed Icelandic rimes means that all such rimes must dominate either two nuclear skeletal points or one nuclear and one licensed rimal point.

This same constraint is operative in Italian and Norwegian with the result that both of these languages are as described in (28):

(28)

1. Vowels are all underlyingly short.
2. Some geminates are lexically present.
3. The rimes of stressed syllables must dominate two positions on the skeletal tier.

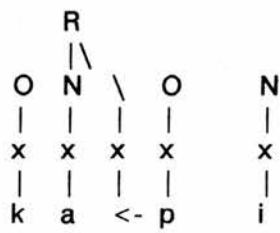
As we are claiming that the BRC is also in operation in Icelandic we assume that the statements in (28) also apply to Icelandic.

<sup>18</sup>The onsets may be branching or simple as will become apparent in the course of the analysis.



To elaborate on the consequences which this claim will have for my analysis we will first consider geminate hard stops. A true geminate, in GP, (Guerssel 1990, Kaye 1990, Yoshida 1990) is a single segment which occupies two adjacent skeletal points. Fitting the word 'kappi' "kahpi" (bully) into a syllabic skeleton yields the following structure:

(29)



The "p" occupies the onset and licenses the rimal position in accordance with the Coda Licensing Principle (Kaye 1991):

(30)

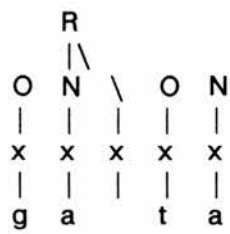
### CODA LICENSING PRINCIPLE

Post-nuclear rimal positions must be licensed by a following onset.

Given the binarity theorem (KLV 1990) a rimal position with a branching nucleus is universally excluded. Gemination can never be found in a rime with a branching nucleus; that is to say, a rime which also contains a long vowel or heavy diphthong. As Icelandic words always have a long vowel, diphthong, geminate or sequence of two consonants, the BRC is always satisfied.

In <gata> "ga:tʰa" 'street' the stop is simple. By virtue of the BRC the rime must still dominate two skeletal points and we find the following structure:

(31)



The Coda Licensing Principle (30) dictates that the "t" of <gata> must occupy the onset as there is no following segment to license it into the rime. It will be seen in due course that the lexically simple "t" is unable to spread to the preceding rimal point (which exists by virtue of the BRC) and as a result the vowel which is the head of the rime lengthens in order to fill the metrically created right point of the rime.

Kiparsky (1984) deals with this phenomenon of vowel lengthening in Icelandic in a very different manner. He claims that Icelandic vowel length is wholly predictable within the lexical phonology framework by a process which lengthens vowels in open syllables. Explicitly he states that:

(32)

Vowels are long when stressed and syllable final, and short otherwise.

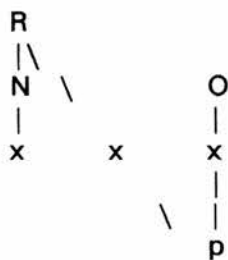
In order to see this claim as applying throughout he has to state that all sequences of two vowels constitute a closed syllable, except for cases such as those in (11) where the

consonants form a branching onset. The apparently closed syllable, long vowel cases, where a single consonant follows a long vowel (for example "ha:s" 'hoarse', "ny:r" 'new') are defined as having an 'extrametrical' unit. Kiparsky's explanation for this is that 'the coda is often allowed to contain extra consonants in word final syllables'. To deal with vowel lengthening, Kiparsky has an open syllable lengthening rule with an ad hoc device to account for cv:c forms as having an extra metrical segment. When the lengthening is seen as a process which occurs due to the operation of a BRC such devices are no longer necessary.

### 2.3.3 SPREADING

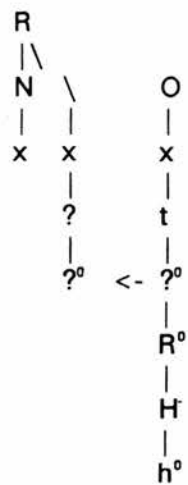
I have stated that in Icelandic the friction element of hard stops must spread in either one direction or the other. In those words with lexical geminates such as <kappi> the geminate has two skeletal points. The segment occupies the onset slot and spreads itself, in the direction of government, onto the governed right branch of the rime. The question remains as to what, in terms of elements, actually occupies the rimal position. One possibility is that the entire segment spreads leftwards as in (33):

(33)



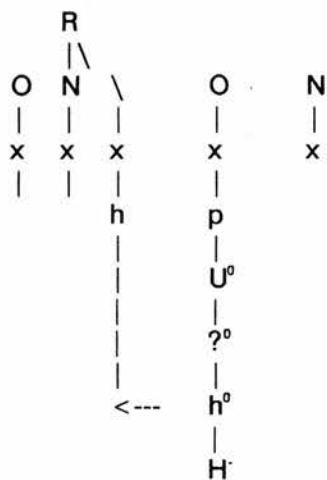
Another possibility is that only the glottal element spreads, as in Southern Italian <dottore> "do?tori".

(34)



In Icelandic however the pre-aspiration data shows that the friction element,  $h^0$  spreads from the geminate onto the rimal point as in (35) below:

(35)



In such cases as (35) the vowel preceding the  $h^0$  is short. In a word like 'gata' (street) "ga:ta" there is a long vowel with no association of onset material to the rime. In other words when there is no spreading of onset material onto the metrically created rimal point, the rime is filled by segmental material from the nucleus. The introduction of a new constraint in the next section will illustrate why no onset spreading can occur in these cases.

To understand the nature of the segments involved we must consider the somewhat unstable behaviour of seemingly long vowels in <gata> type words. The nature of these vowels is somewhat variable. They are not always long. More explicitly, they can become short during the course of a derivation. A brief comparison of English forms such as 'see' "si:"; 'seen' "si:n" and 'need' "ni:d"; 'needed' "ni:did" with forms such as 'leave' "li:v"; 'left' "left" show that true long vowels are invariant throughout morphological derivations (Kaye, Hellan & Jungsen 1990, henceforth KHJ). We are left with a question as to the nature of the apparently long vowels which are not always long. The idea of the Jungsen vowel (KHJ 19-90) enables us to explain the behaviour of vowels in 'gata' forms as opposed to those in words like 'see'. The Jungsen vowel is basically a vowel which spreads into a metrically created point so that it seems to be long. This behaviour has the outward appearance of being in conflict with another principle - the Principle of Strict Cyclicity - which states:

(36)

Representations made within an earlier cycle may not be undone.

Metrically created points are not subject to this condition (KHJ. 1990) with the result that the so called Jungsen vowel is able to occupy a point when there is no other segmental material which can do so.

#### 2.3.3.1 The Cyclic Spreading Constraint

As geminate stops are able to occupy both rime and onset positions, it is necessary to explain why the single stop in 'gata' type cases cannot. In order to do so I shall introduce the following principle:

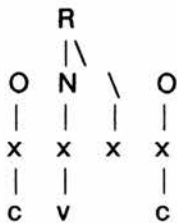
(37)

### The Cyclic Spreading Constraint (CSC)

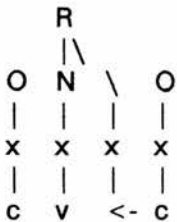
**Non-nuclear segments cannot spread to points they have not occupied lexically within a cyclic domain.**

The CSC enables us to distinguish clearly between forms with a single stop which occupies only one lexical point and which therefore can have no onset material in the metrically created rimal point, as in (38), and forms where the stop is geminate and lexically occupies two distinct points, as in (39):

(38)



(39)



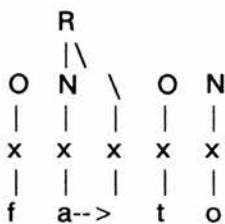
The CSC prevents the following onset from spreading into the rimal point but does not prevent the preceding vowel from lengthening into it. We will return to the significance of the cyclic domain in our analysis of derived geminates.

2.3.2.2 An Italian Application of the CSC

One might argue that constraint is an ad hoc device to account for Icelandic distribution. A consideration of Italian shows that its applications go far beyond the immediate concerns of this chapter.

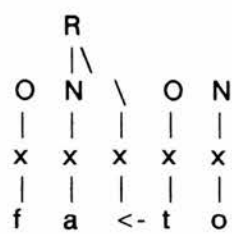
Many facets of the Icelandic data are eerily reminiscent of Italian. Italian, like Icelandic, has a branching rime constraint on stressed syllables (Nikiema 1988). Consider the word 'fato' (fate). The "t" in this word is lexically simple. The operation of the branching rime constraint means that, just as in Icelandic, a metrically created rimal branch exists. The CSC prevents the "t" from associating to this point. However the "a" is able to spread to it and does so with the result that the output form is "fa:to" (see Vogel 1978; 25):

(40)



In Italian 'fatto' (fact), however, the "t" is geminate and therefore occupies two skeletal points. The point which exists by virtue of the BRC is filled by segmental material from the geminate stop which is able to occupy it, thus producing the output form "fatto".

(41)

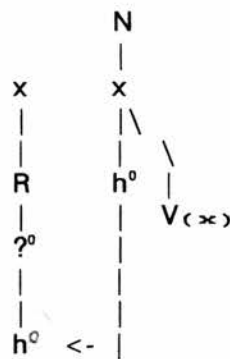


It is only with the application of the CSC that we are able to differentiate the forms of (40) and (41), which otherwise would be identical.

2.3.3.3 An Icelandic Application of the CSC

In Icelandic, the lack of a relationship between the "t" and the preceding rimal point as dictated by the CSC means that the friction element CANNOT move to the left. It must move somewhere, and so it moves to the right, resulting in post-aspiration. The question remains as to the destination of the rightward moving h. The skeletal point which follows is that of the nucleus which licensed the onset containing the h in the first place. The friction element spreads onto the following point and shares it with the nucleus in the configuration of a light diphthong as illustrated in (42):





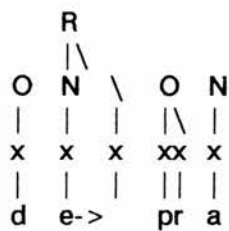
This structure leads us to make the prediction that the duration of the post-aspiration "h" should be noticeably less than that of the pre-aspiration segment, as the former shares a skeletal point which the latter occupies by itself. This is indeed the case (Garnes,1974).

2.3.4 {P,T,K} + {J,V,R} CASES

In the "p,t,k" followed by "j,v,r" cases, (i.e. words such as <depra> 'sadness') the presence of the long vowel is once again predictable given our earlier hypothesis. The {j,v,r} segments are not of a charm or complexity to licence a preceding stop as a rimal complement (KLV 1990). The {j,v,r} segments are all simplex and hence potential recessive members of a branching onset. The stop + {j,v,r} sequences are syllabified as branching onsets; that is, to say, as two skeletal points sharing a single position on the onset tier. The following example represents the syllabification of 'depra';

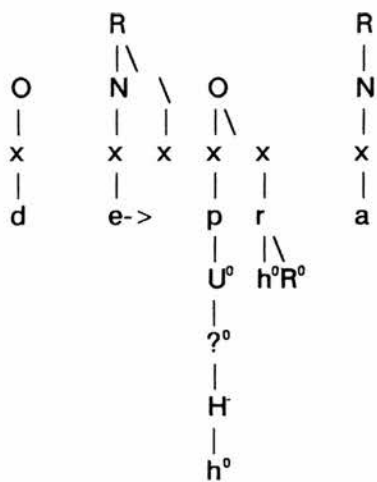
(43)

<depra> "de:pra"



The branching onset is unable to fulfil the BRC, and due to the application of the CSC no segmental material from the "p" is able to spread into the rimal point. It is the nuclear material which must spread into the metrically created slot producing "de:pra". The "p" is unable to pre-aspirate onto the point to its left and so post-aspirates to the right to share the point occupied by the "r" resulting in the form "de:p<sup>h</sup>ra".

(44)

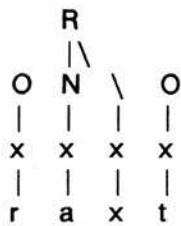


2.3.5 FRICATIVE + STOP SEQUENCES

In the cases considered so far the metrically created rimal point has no unique segmental material. However, there are many words where rime contains a lexical fricative which is licensed by the following 'hard' stop. Consider <raxt> "raxt" 'moist.neuter':

(45)

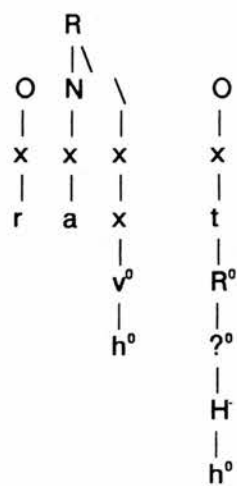
"raxt" 'moist'



In (45) the "t" of the onset licenses the "x" of the rime. This governing relationship between the fricative and following onset means that (given our earlier hypothesis that the stop aspirates onto the rime when there is a lexical association between rime and onset) we expect the  $h^0$  of the "t" to spread left towards the rime which it is governing. A consideration of the segmental representation of the points involved indicates that in fricative + stop cases there is another factor to be taken into consideration; namely, that there is already an  $h^0$  present in the segmental content of the rime.

(46)

"raxt"

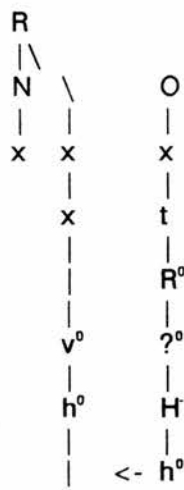


At this point it is necessary to recall another Principle of Government Theory from Chapter One. The Obligatory Contour Principle (OCP) states that:

(47)

On a given level of representation no two adjacent elements of the same kind can occur.

It can be seen from diagram (46) that the environment in question is precisely where such a principle could apply. If OCP effects are triggered by the two adjacent friction elements in rime and stop, the h<sup>0</sup> of the stop should bind to the h<sup>0</sup> which is already present in the preceding segment. The result is that there is no obvious pre- or post-aspiration in rimal configurations of fricative + stop.



In the initial "sp", "st", "sk" cases the de-aspiration of the stop is the result of a similar process. The preceding rimal "s" contains the  $h^0$  element also present in the following stop.<sup>19</sup> As with the fricative + stop sequences, this acts as a trigger to the OCP and the  $h^0$  of the stop binds to that which is already present in the "s".

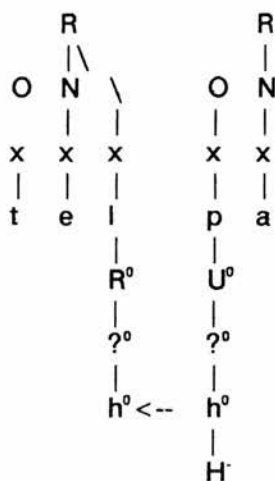
2.3.6 LIQUIDS AND NASALS + STOPS

Fricatives are not the only segments which can occupy the rimal branch in Icelandic. Liquids and nasals can also be licensed by following stops into the rimal slot. The licensing role of the stop means that there is a government relationship between rimal complement and following onset. The spreading of  $h^0$  follows the direction of this government, from stop to rime. That is, to say, the  $h^0$  spreads leftwards from the governing stop to the preceding liquid or nasal. This results in the devoicing of liquids and nasals which are immediately followed by a member of the set {p,t,k} and an apparent lack of aspiration in the stop.

<sup>19</sup>Evidence is presented in KLV (1990) and Kaye (1992) to show that initial s + c sequences are syllabified as rime and onset.

This is illustrated in (49) which shows the representation of <telpa> "telpa" 'girl'.

(49)

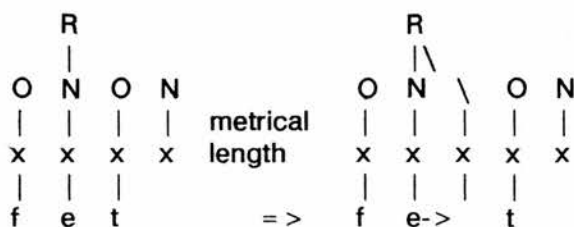


The h<sup>o</sup> of "p" spreads in the direction of its government, onto the preceding liquid, thus devoicing it. Given the restriction on spreading - that nothing can move simultaneously in two directions - the "p" is therefore without post-aspiration.

### 2.3.7 DERIVED ENVIRONMENTS

Our hypothesis now accounts not only for lexical geminates but for their derived counterparts. Consider the word 'fat' "fe:t".

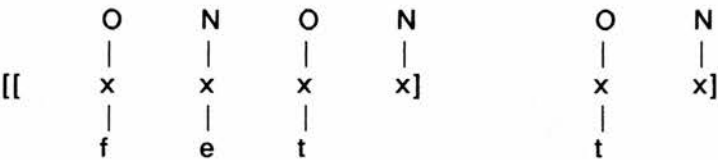
(50)



The nucleus spreads onto the metrically created point. As in <gata> "ga:t'a" the spreading of the non-geminate "t" is prevented by the application of the CSC and the output form is "fe:tʰ".

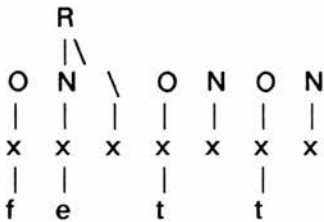
The neuter form is constructed with a suffixal "t". Let us consider what happens to the environment with the setting up of the new domain. We have the following representation:

(51)



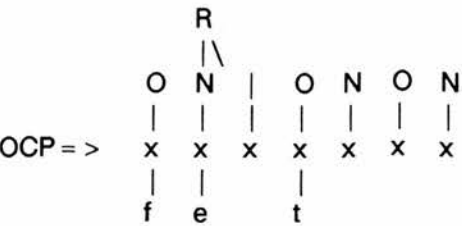
With the application of the BRC this structure is modified to give (52):

(52)



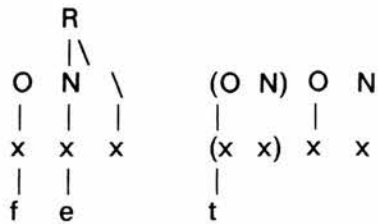
There are now two "t"s in adjacent onset points as shown in (52). As this represents another OCP violation one "t" is deleted leaving a single segment.

(53)



There are now two empty points. A null nucleus cannot license a null onset. The "t" of the neuter case is not in the same cycle as the deleted "t" and so it may spread to the metrically created rime without violation of the CSC, as in example (54):

(54)



The "t" occupies the rimal point by spreading its h<sup>0</sup> element onto it and the resulting form is "feht".

2.3.7.1. Some Consequences for Italian

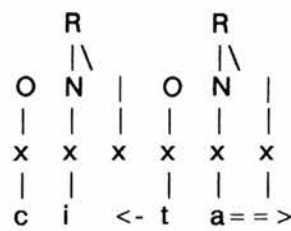
Earlier we mentioned the implications of the CSC for Italian when we showed that, as in Icelandic, the vowel spreads into the rimal point when the constraint prevents an onset from doing so. To illustrate the implications, which our discussion of derived geminates has,



for Italian, we will consider the effect of setting up a new cycle where the CSC need no longer apply.

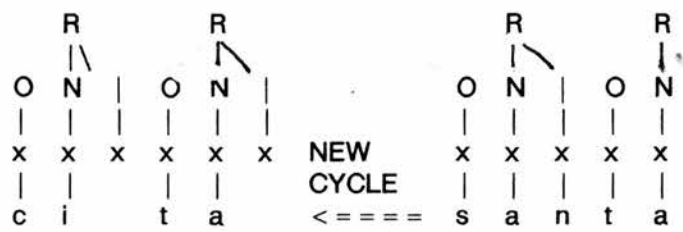
In a case where there is no onset to govern the metrically created rime, the rimal point of the stressed (second) syllable of <citta> "citta:" 'city' is filled by nuclear material (there being no onset material available to it):

(55)



We can establish a new cycle with the addition of a new word (KLV 1990:205), such as <santa> 'holy'. The initial "s" in this form is single, but when coupled with <citta> the setting up of a new cycle means that the CSC no longer applies and the "s" can associate to the preceding rime just as in the Icelandic derived geminate cases.

(56)



The output form is "ci?tassanta" with a short "a" and the "s" spreading to the rime which it is now able to occupy. This is the well-known radoppiamento sintattico effect.

#### 2.3.7.2. Summary

This section has tried to account for aspiration of derived geminates by pointing out that the environment in such examples is one where the CSC, already shown to prevent aspiration in the single stop cases, is no longer applicable.

The Italian data serves as an illustration that this phenomenon is neither language-specific nor arbitrary, but an illustration of the operation of a set of principles and parameters on Universal Grammar. Icelandic pre-aspiration, however, is not restricted to cases where there are apparent geminates, be they underlying or derived. This brings us to the next section of our analysis, which is a consideration of another environment where pre-aspiration occurs.

#### 2.3.8 {P,T,K} + {L,M,N} CASES

##### 2.3.8.1. The Environment

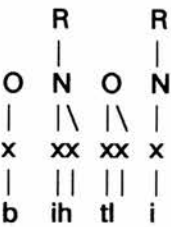
In words such as "ehpli" 'apple', "johtni" 'giant', pre-aspiration also occurs to stops when the segment following is a liquid or nasal. In order to arrive at a clear idea of the precise nature of the environment in such cases we must first consider the syllabification of the relevant forms.

Consider the word "bihtli" 'beetle, dat.sing.'. In the previous chapter we saw how the interaction of the principles of directionality, locality and complexity resulted in a highly restricted theory of constituent structure. Earlier in this chapter we saw that the pre-aspiration "h" is generally regarded as being of segmental duration. Putting these two together presents us with only one possible syllabification of forms such as "bihtli".

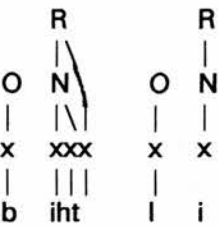
Consider the following skeletal representations:

(57)

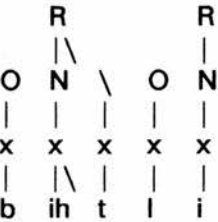
(a)



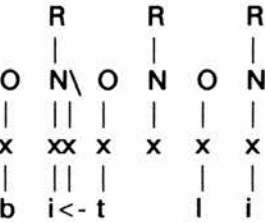
(b)



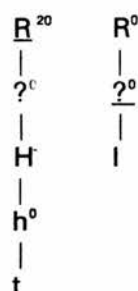
(c)



(d)



The first structure (57a) has a branching onset whose members are "t" and "l". The underlying representation of these segments in (58) shows that there are no elements unique to "l". Explicitly, the representation of "l" contains no elements which are not already present in "t".



A syllabification which placed both of these forms in a branching onset would result in a violation of the OCP. Figure (57a) is an impossible structure containing an illicit branching onset.<sup>21</sup>

In (57b) there is an initial branching rime which dominates a branching nucleus. Constituents within government theory are maximally binary due to the application of the principles of directionality and locality; yet a rime in a structure such as this would dominate three skeletal points.<sup>22</sup> Such a structure, then, is also illicit.

Figure (57c) shows a structure where the "h" does not have segmental duration, but shares an x slot with the nuclear "i". Its shortcomings do not end there, as the "l" occupying the onset following the rime is insufficiently complex to license the negatively charmed, and

<sup>20</sup>By convention the HEAD of an expression is underlined. If we consider a neutral unreleased /t/, one which has no  $H^r$  or  $h^0$ , we find that the only difference between /t/ and /l/ in fact resides in the role played by the two elements which they share. In /t/ the  $R^0$  element would be the head while in /l/ the constriction element would be.

<sup>21</sup> It will be later shown that there is a parameter in Icelandic, as in Italian, whereby /l/ cannot occupy a governed position in an onset. The OCP violation triggered by such a branching onset is however, to my knowledge, universal.

<sup>22</sup> With tripartite structures like (57b), the head of the rime is not next to the rightmost member. The centre point, which is adjacent to both left and right points, could only govern them by governing in two directions.(KLV 90).

more complex, segment "t" into the rimal position. Any such configuration violates the principle of complexity (recalled in (59)) as can be seen from the underlying representations of the two segments in (58):

(59)

X may govern Y iff:

1. X is charmed and Y is neutral.
2. X is of a greater complexity than Y.

Figure (57d) has a nucleus between the "t" and the "l". This structure is in fact the correct one; and the nucleus between the "t" and "l" has no segmental content due to the application of the Empty Category Principle (Charette 88, KLV 90). This principle, discussed in Chapter One, is reproduced here for the reader's convenience:

(60)

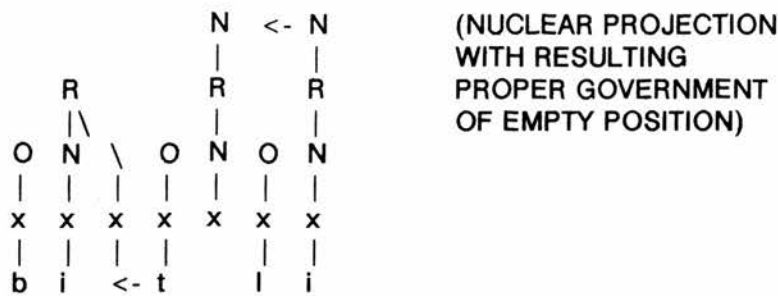
A position may be uninterpreted phonetically if it is properly governed.

We recall that the Projection Principle states that in order for a segment to be a proper governor it must be adjacent to the governee (at some level of projection) and must itself have phonetic content.<sup>23</sup> In (57d) this condition is met. The nucleus separating the "t" from the "l" is properly governed by the following nucleus "i". The nucleus can remain unrealised as a result of this proper government.

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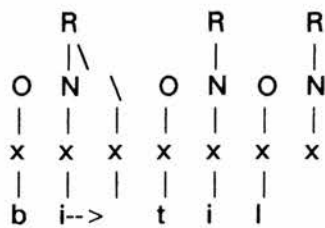
<sup>23</sup> This is a somewhat simplified version. For full details of the ECP and the projection principle the reader is referred to the references cited.

(61)



In (61), the empty position is phonetically empty only because the following nucleus is filled and can thus license it. In the nominative form of the same word we find that there is no proper governor. The domain final empty nucleus is the only following nuclear position available to license the nucleus between the "t" and the "l", as the position in such forms has phonetic content and the output form is "bi:til" shown in (62):

(62)



There are many other cases where this phenomenon is apparent. Two such forms are presented below. For numerous examples of vowel/zero alternations in Icelandic the reader is referred to Thrainsson (1978) and Arnason (1986).

(63)

"kehtlum"	'kettle'	dat. vs. "ke:til" nom.
"johkli"	'glacier'	dat. vs. "jo:kul" nom.

Other words, such as "ehpli" 'apple', do not alternate as they have a proper governor for the empty position in all their morphological cases. In such forms the empty nuclear position is always immediately followed at the level of nuclear projection by another nucleus which has phonetic content.

(64)

nom.	"ehpli" 'apple'	"ehpli" 'apples
acc.	"ehpli"	"ehpli"
dat.	"ehpli"	"ehplum"
gen.	"ehplis"	"ehpla"

### 2.3.8.2 Some Further Considerations

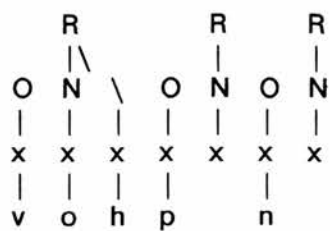
The syllabic structure of some of the forms which apparently violate the CSC is now seen to be such that the preaspirating segment is not followed by "l","m",or "n", but by a properly governed empty nucleus. This description of the environment, however, does not take certain facts about Icelandic syncope into account.

Icelandic syncope occurs only in a very limited segmental environment. As in certain other languages, such as German and English, the onset following the vowel which is subject to syncope is always a liquid or a nasal. This gives us alternations in English such as 'simple' "sɪmpəl" but 'simply' "sɪmplɪ", 'handle' "hændl", but 'handling' "hændlɪŋ". This restriction shows that the proper government of the empty position cannot be reliant solely on the following nucleus. If the only criterion for the application of proper government was the availability of a proper governor, syncope would occur in all cases where this requirement was met, rather than being dependent on the segmental content of an onset.

An additional point is that many Icelandic words appear to have nuclei which are not realised, but which have no proper governor to license their emptiness.

In words such as "vohpn" 'weapon,' "ruhtl" 'cart', etc, there is an unrealised empty nucleus between the stop and the following segment but no following nucleus which can act as a licenser:

(65)



In (65) above, the empty nucleus separating the nasal and the stop is followed by the word final empty nucleus. We here recall that word final nuclei are themselves licensed by virtue of their position and are therefore not potential proper governors.

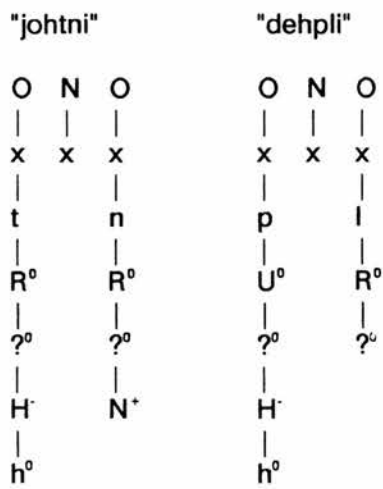
These problematic forms, viewed in the light of the restrictions of proper government, appear to point in the direction of an explanation different from that suggested by our initial observations. Some other factor or factors must allow the empty position in "vohpn" type forms to remain unrealised.

Before proposing an explanatory analysis of the apparent CSC violations in the {p,t,k} followed by {l,m,n} words we must first understand the nature of the environment where the violations occur. With this aim in mind let us consider some apparently disparate facts:



1. In environments where syncope occurs the left onset is always more complex than the right:

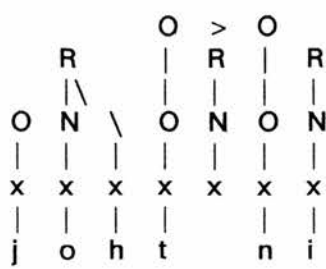
(66)



2. When the rightmost segment is stronger than the left in an environment where syncope could occur, it does not do so and the vowel is realised. (Note: this does NOT claim that syncope will always apply when the right is weaker; only that it will not apply when the right is stronger.)

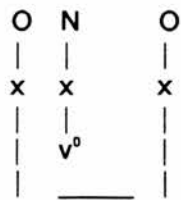
It is possible that what we are dealing with here is some kind of governing relationship between the 'hard' stop and the following onset at the level of onset projection.

(67)



In (67), the empty nuclear position is contained within the onset to onset governing domain.  
 In Kaye (1990:23,24) an empty nuclear position is similarly shown to be licensed by being contained within the governing domain of two onsets, with the domain being set up as the result of a segment being doubly linked.

(68) (from Kaye 1990)



Kaye adds a proviso to the ECP to the effect that "this governing domain (i.e. the governing domain which is formed by a doubly linked segment) licenses an empty nucleus contained within it."

Let us now propose an extension of this proviso to the effect that empty positions contained within any onset to onset governing domain may be licensed . The conditions for this government relationship to exist would be identical to the conditions which allow any projection government relation to occur. Viz:

(69)

1. In order to enter into a governing relationship, the segments would have to be adjacent at some level of projection.
2. The governor would have to be of the correct charm and/or complexity to govern the onset to its right.

The first condition is easily met in Icelandic where the two onsets are adjacent on the onset projection as in (67). The second condition is met as illustrated in (66). A hard stop is both charmed and of a greater complexity than any following liquid or nasal and can therefore act as a governor. The application of the second condition also accounts for the limited distributional occurrence of syncope in Icelandic (as well as in German and English) in so far as this onset to onset government can occur only when the stop is followed by a potential governee. The licensing of nuclei contained within such a domain is not only consistent with the analysis of Kaye (1990), but will be shown to be an important factor in accounting for apparently problematic forms such as "vohpn".

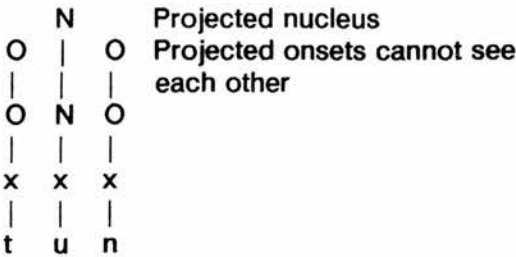
#### 2.3.8.3 The Nature of the Process

Having discussed the environment in some detail we now consider the aspiration process in words where the {p,t,k} is followed by {l,m,n}. Pre-aspiration occurs when the stop and following liquid/nasal are phonetically 'next' to each other. This apparent adjacency is the result of a governing relationship between the two onsets licensing the nucleus which would otherwise intervene. It follows that pre-aspiration in such cases can happen only when such a governing relation exists. Returning to the conditions in (69) above, we can consider the conditions which must be fulfilled and how the fulfilling of these conditions results in what appears to be a violation of the CSC.

The first condition, (40), is adjacency; in order for the two onsets to meet at the level of projection no other segment must intervene between them. We saw from (67) that this was the case in "johtni". In the nominative form, "jo:tun", a vowel occupies the nucleus separating the two onsets. Explicitly, the nucleus in "jotun" has segmental content and would therefore also be projected. As a projected nucleus it would intervene between the

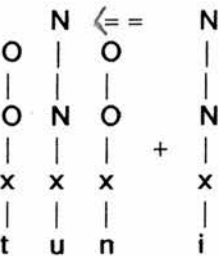
onsets on their projection and prevent the fulfilment of the adjacency condition as illustrated in (70):

(70)



In the form "johtni" there is a proper governor available to this position:

(71)

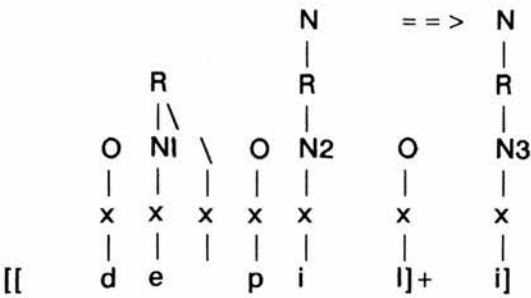


The nucleus of the dative suffix is also projected and can thus properly govern the nucleus separating the stop and the nasal. As a properly governed nucleus, the position between "t" and "n" is now a licensed empty category. An empty category is not projected, and the "t" and the "n" can now 'see' each other on their onset projection.

This can be illustrated in a step by step manner as follows:-

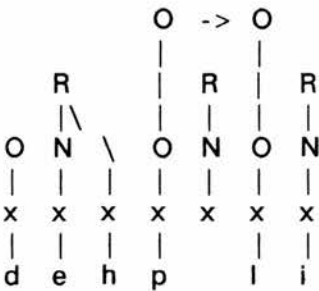
(72)

<depill> + 'i' -> "depli" 'dot, dat.'



In (72) the nucleus of the dative sees the "i" separating the "p" and "l" at the level of nuclear projection. N1 acts as proper governor to the nucleus occupied by "i" and N2 becomes a licensed empty position.

(73)



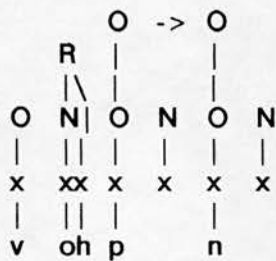
In (73), the only thing which now intervenes on the constituent level between the "p" and the "l" is a properly governed empty nucleus. As an empty category the nucleus is no longer projected. Nothing intervenes between the onsets at the level of projection and so a governing domain is set up between them.

Condition 1 of (69) can be satisfied if, and only if, the nucleus between the prospective governor and governee is a licensed empty position. Thus far we have

considered cases where the nucleus has become a licensed empty category as a result of proper government. Earlier in this section we proposed that a licensed empty nucleus could also be licensed by virtue of being contained within an onset to onset domain. Such nuclei, as empty positions, would need no proper governor to prevent them being projected. In a word such as "vohpn" the nucleus separating the two segments is empty, and so nothing prevents the consonants on either side from meeting.

(74)

"vohpn"



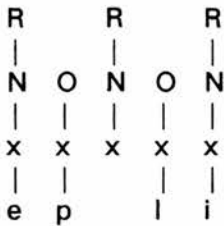
Condition 1 of (69) is satisfied and the two onsets can immediately form a relationship, unlike the "johtni" cases where proper government must first apply in order for the adjacency requirement to be met. Once the onsets have met and formed a governing relationship, the position can never be realized because it is contained within a governing domain. Pre-aspiration only occurs when there is a governing relationship between the stop and the following onset. Explicitly pre-aspiration can occur only when the stop has the role of governor. Let us consider why this might be so. As stated above, the stop is able to see the following liquid/nasal as the result of the fulfilment of the first requirement of (69), and the second condition now applies. The stop is more complex than the following segment and so assumes the role of governor.

I will claim that once a segment has attained governing status at any level of a derivation it may retain that status throughout.<sup>24</sup> This means that the stop, as a governor at the projection level, may now govern at the constituent level. As a governor at the constituent level it is able to govern the metrically created rimal point. It does so by preaspirating onto it. There is thus simultaneous government of the {l,m,n} at the level of projection, and of the rimal slot at the trans-constituent level, within the same cycle. Thus, stops which are governors in any given domain can pre-aspirate within that domain without violation of the CSC because the stop's role as governor enables it to occupy the metrical point lexically.

2.3.8.4 "EHPLI" Type Words

The final cases to be considered are forms such as "ehpli", where there is no vowel/zero alternation. The posited underlying form<sup>25</sup> is:

(75)

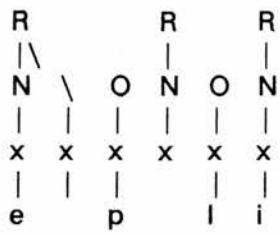


The metrically created rimal point is added to produce the following:

<sup>24</sup>It is possible that a segment which is a governor at some level MUST retain its governing status throughout a derivation. Such a claim would be borne out by the German and English cases cited. It would however take us beyond the scope of this thesis to justify such a claim empirically.

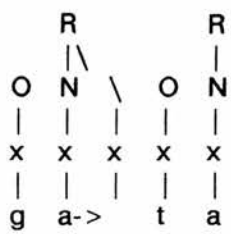
<sup>25</sup>It will be assumed that, as in Italian, only simplex segments may occupy the governed branch of an onset. Hence long vowels never occur before {p,t,k} followed by {l}.

(76)



In the above structure there are no internal domains and we expect application of the CSC to prevent association of the following onset. This was the case for "ga:ta", with "gahta" being an impossible form.

(77)

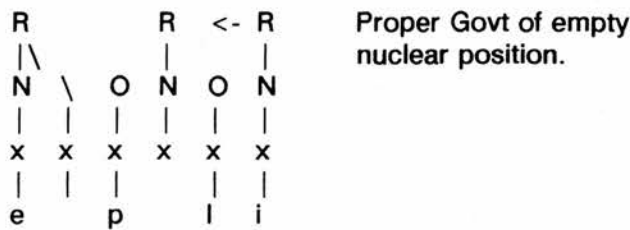


In fact, in 'ehpli' type words it is an "e:pli" form which is illicit with the correct form being "ehpli". In other words the metrically created point in "ehpli" is occupied by the following onset. The difference between "ga:ta" and "ehpli" words lies in the role of the onset following the metrical rime. In "ga:ta" the following "t" has no governing role, unlike the "p" of "ehpli" which, just as in the alternation cases above, is the governor of the following liquid "l". We have already stated that a stop which has attained the role of governor at the onset level may simultaneously govern at the constituent level. This government is manifest in the spreading of aspiration onto the rimal point.



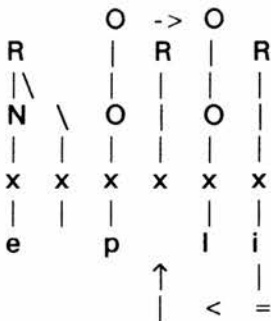
Forms such as "ehpli" are identical to 'derived' "dehpli" words with the aspiration occurring whenever and wherever the stop achieves governing status. Examples (78) and (79) show the representation of "ehpli". In (78) we see proper government of the nucleus which intervenes between "p" and "l".

(78)



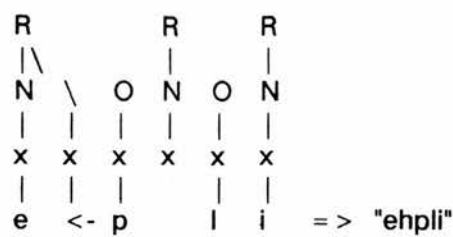
The "p" and "l" are adjacent at the level of onset projection and are able to meet and create a domain, licensing the contained empty nucleus.

(79)



The "p" is a governor at the level of onset projection and thus can also govern at the trans-constituent level. The preceding rimal point has no segmental content of its own (which could prevent such government by violating the constraints of charm or complexity) and so the "p" governs the rime. This government is manifest in the spreading of its h<sup>0</sup> element.

(80)



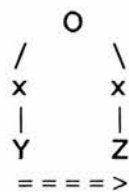
2.4 CHAPTER SUMMARY

From this chapter we see that the various aspiration processes are the result of the spreading of the  $h^0$  element from the hard stops which contain it. The occurrence of such processes is not optional, and so we can state that Icelandic has a parameter setting whereby the  $h^0$  element of hard stops must spread. The direction of spreading is determined by the governing properties of the segment in question. The spreading of the  $h^0$  always follows the direction of government. When there are two levels of government, as in "johtni" or "ehpli", where the stop is simultaneously governor at the projection and the inter-constituent levels, the spreading follows the **lowest level** of government.

The above constraint on the directionality of spreading correctly predicts that:

- a. Heads of branching onsets must post-aspirate.

(81)



- b. Onsets which govern rimal points must pre-aspirate.

- c. Onsets which are projection level governors must pre-aspirate when there is a point at the interconstituent level which they are able to govern.

A branching rime constraint operates on stressed Icelandic syllables, and the metrically created rime must be occupied by segmental material. The application of the CSC restricts the spreading of onset material onto positions with which it has had no lexical relation within the current domain. Thus, in lexical items where there is no onset which can occupy the metrically created rime, the rimal branch will be occupied by segmental material from the nucleus. Icelandic 'long' vowels then are simply the result of either a/ the lack of onset material to fill the metrical rime, or b/ the lack of a relationship between the onset material available and the created point.

Pre-aspiration is the way in which the occupation of a rimal point, by available onset material, is manifest, as are de-aspiration ( in "raxt" cases) and devoicing (in "telpa" cases). Post-aspiration is the result of the lack of just such a relationship between the stop and the preceding point.

This analysis shows why pre-aspiration and long vowels, and also why post-aspiration and short vowels, are mutually exclusive, and also offers an account of the general nature of the aspiration process.

## CHAPTER THREE

### FINNISH CONSONANT GRADATION

#### 3.0 INTRODUCTION

Consonant Gradation in Finnish has provoked considerable discussion among theoretical linguists. Lyle Campbell begins his 1976 paper with a discussion of the role of the Finnish language in general as a means of revealing inadequacies within theoretical frameworks. Unfortunately, this method is not bi-directional. A theory which is incapable of explaining a language obviously requires some revision (given that certain initial assumptions are made about the way the researcher has considered the material, the basis of the theoretical approach, etc.); yet a theory which can explain any language is not necessarily a good theory on the basis of that ability alone. The key notion is one of restrictiveness - namely, the degree of restrictiveness within the theory itself; whether or not it accounts for the data within a strictly defined and limited set of theoretical options which in the end lead to some explanation about the process under investigation. This chapter looks at a process which on the surface appears to violate many restrictions and generalisations and aims to explain it by showing how it can, and, in fact, does work within them.

Finnish consonant gradation (henceforth CG) is one which is traditionally divided into two categories - Qualitative and Quantitative. It is usually considered as applying separately in nouns and verbs. One aim of this analysis is to show that neither of these distinctions is necessary. Qualitative and quantitative gradation are shown to be the same event occurring to different segments in the same general environment. In keeping with the claims of this thesis, Finnish CG, like other phonological processes, applies regardless of morphological categories.

Morpheme boundaries (in accordance with Cathey and Wheeler 1986), or the lack of them, will be shown to have no part in the environmental conditions for consonant gradation. The presence of domain final phenomena such as final licensed empty nuclei plays a crucial role in our definition of the CG environment.

The analytic/non analytic nature of the morphology, as mentioned in Chapter One, explains the behaviour of the possessive suffixes, hitherto regarded as exceptional with respect to CG. The proposed account of the process is applied to each of the verbal categories and their CG, to illustrate why such notions as inverse gradation (Holman 1990) are unnecessary given a principled account of the process.

This analysis makes some basic assumptions about Finnish syllable structure which will be borne out by the analysis as it proceeds. Finnish will be seen to be a language which has **no branching constituents**; that is, a language which is basically ONONON, where apparent consonantal sequences are in fact single onsets separated by empty nuclei. This is in marked contrast to the 'heavy syllables' usually attested in Finnish (Holman 1984, 1986, Keyser & Kiparsky 1984 etc.).

### 3.1 THE DATA

I begin by considering the precise nature of the change undergone by the segment(s) in each of these CG processes as they occur in Helsinki Finnish (which is sometimes referred to as 'standard' Finnish).

### 3.1.1 QUALITATIVE GRADATION

Qualitative gradation involves alteration to the internal structure of the affected segments. Within this process the following transformations occur:

(1)

#### SINGLE STOPS

- a. p->v <papu> 'bean' -> <pavun> 'bean, gen.'
- b. t->d <katu> 'street' -> <kadun> 'street, gen.'
- c. k->0 <aikoa> 'to intend' -> <aion> 'I intend'

(2)

#### LIQUID STOP SEQUENCES

- a. lp->lv & rp ->rv <kylpy> 'bath' -> <kylvyssa> 'bath, inessive,
- b. lk->l <palko> 'pea pod' -> <palon> 'pea pod, gen.'
- c. lk->lj <solki> 'buckle' -> <soljen> 'buckle, gen.'
- d. lt->ll <ilta> 'evening' -> <illan> 'evening, acc.'
- e. rt->rr <virta> 'stream' -> <virran> 'stream, gen.'

(3)

#### NASAL STOP SEQUENCES

- a. mp->mm <kampa> 'comb' -> <kamman> 'comb, gen.'
- b. nt->nn <hinta> 'price' -> <hinnasta> 'price,elative'
- c. nk->ŋŋ <hanka> 'snow crust' -> <harggon> 'snow crust, gen.'

(4)

#### "h" STOP SEQUENCES

- a. ht ->hd <lehti> 'leaf' -> <lehden> 'leaf, gen.'
- b. hk ->h <vihko> 'notepad' -> <viholta> 'notepad, ablative'

### 3.1.2 QUANTITATIVE GRADATION

This type of gradation involves the loss of a segment which is apparently a member of a geminate cluster.

(5)

pp->p <oppia> 'to learn'      -> <opin> 'I teach'  
tt->t <ajattelen> 'I think'      -> <ajatelle> 'to think'  
kk->k <kukka> 'flower'      -> <kukan> 'flower, acc.'

Similarly:

rpp->rp, lpp->lp, rtt->rt, ltt->lt, rkk->rk, lkk->lk, etc.

mpp->mp, ntt->nt, nkk->nk.

3.1.3 THE ENVIRONMENT

In traditional descriptions of the environment, CG is said to occur in so-called 'closed syllables' (Campbell 1976, Karlsson 1982, Keyser & Kiparsky 1984, etc.) with various (and somewhat numerous) exceptional forms and derivations. The framework in which this present study is couched prohibits a description of the environment in such terms, as traditional notions of the syllable are not part of its general make-up.

The data indicate that the process can be summed up as occurring when the gradable onset is followed by an onset which in turn is not followed by an audible nucleus. Formally represented, the context of consonant gradation is:

(6)



\*denotes gradation site.

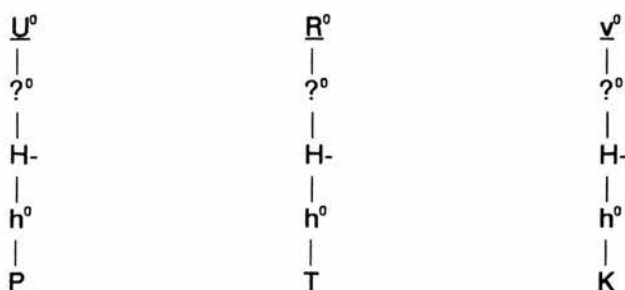
The result of gradation is that the affected onset is 'voiced'<sup>26</sup>, spirantized, assimilated or degeminated.

### 3.2 THE NATURE OF THE CHANGE: Simple Cases

#### 3.2.1 THE AFFECTED SEGMENTS

It is the Finnish stop series {p,t,k} which undergoes CG. The stop itself undergoes the alteration, although the outcome can vary according to the adjacent segments and the internal composition of the affected point. The underlying representation of these stops within this framework is:<sup>27</sup>

(7)



In traditional terms these are tense, aspirated stops (Karlsson 1982, Paunonen 1973, Wiik 1967, etc).

<sup>26</sup>The term 'voicing' is used in its broadest sense here, i.e. the sound in question is not fortis.

<sup>27</sup> The reader is referred to Chapter One for a discussion of the symbols used in these presentations.



From the description of the qualitative gradation process it will have been noted that these segments become "v", "d" and 0, respectively. As each of these changes involves the segment in question becoming less complex (having fewer elements), it follows that our first statement about the nature of the process is that it is one of lenition, a process which involves the loss of segmental material (Harris 1990).

### 3.2.2 THE RESULTING SEGMENTS

I will claim that it is the friction element  $h^0$  and the  $H$  element which are lost from each stop as the result of CG. The high tone  $H$  is never part of the representation of segments which do not have  $h^0$  in Finnish. In addition to the stops of (7) the only Finnish segment which contains the  $H$  element is "s",<sup>28</sup> shown in (8) below, which also contains  $h^0$ .

(8)



It could thus be stated that a binding exists in Finnish between the  $H$  and the  $h^0$  such that the  $H$  element comes, as it were, with  $h^0$  attached. Thus we can formulate a constraint such that:

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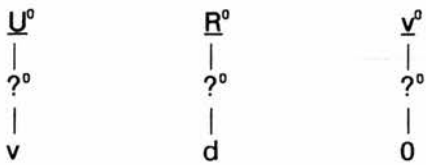
<sup>28</sup>In the section on the nature of the gradation process (see 3.7, below) a justification of this negatively charmed representation of "s" will be given.

(9)

If an H' element is present in any given representation the h<sup>0</sup> element will also be present.<sup>29</sup>

From this it follows that any lenition process involving the loss of h<sup>0</sup> will also involve the loss of H'. The lenition process described above, where these two elements are lost, results in the following segmental structures:

(10)



Let us now look at each of these proposed representations individually. With the loss of H' and h<sup>0</sup>, "p" is reduced to two elements, U<sup>0</sup> and ?<sup>0</sup>. In (10) above this combination of elements is described as "v". Thus "v" is represented not as a fricative (the h<sup>0</sup> has been lenited) but as a glide.

This proposal is based on general observations about the phonological status of so-called 'voiced fricatives'. The term 'voiced fricative' implies a symmetry of the kind found in stops, namely, that there can be in languages a series of 'voiced' and 'voiceless' stops and a series of 'voiced' and 'voiceless' fricatives. But many languages have a {p,t,k} series and a {b,d,g} series without having a similar contrast in fricatives. Spanish, for example,

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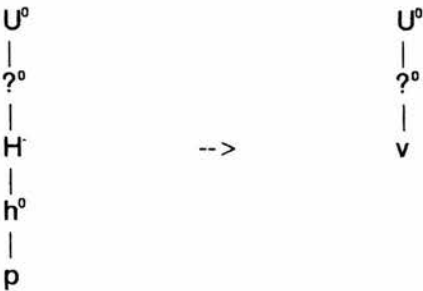
<sup>29</sup>Note that the reverse is not true as in, for example "h", which consists of only h<sup>0</sup> in the head position. Thus the constraint has to be as stated: if H' then h<sup>0</sup>, but not necessarily if h<sup>0</sup> then H'. There is a similar constraint in operation in Korean: (Rhee 1992).

has both 'voiced' and 'voiceless' stops and yet has no set of 'voiced' fricatives to complement the voiceless ones.

In English there are two sets of both fricatives and stops with an apparent voicing contrast. If we assume that p:b as f:v, we expect a certain consistency in the behaviour of "b" and "v" as compared to "p" and "f". Both "p" and "b" can be the head of a branching onset, as in 'prince', 'play', 'blight', 'brim', etc. The segment "f" follows this pattern in data like 'freedom', 'flint' etc; but when it comes to "v" we find that, unlike its voiceless counterpart, it cannot be the head of a branching constituent and forms such as 'vree'\* are illicit. If "f" and "v" were different from each other in precisely the same way as "p" and "b" such disparate behaviour would be unexpected. However if the so-called 'voiced' fricative was weaker, more akin to a glide, such behaviour would be as expected. It is worth noting that there are many languages where "v" occurs as the result of historic "w"->"v" such as Polish, German, Russian, and where it retains all its weak, glide-like properties.<sup>30</sup>

Given these facts I represent the decomposition of "p" as:

(11)



<sup>30</sup>I am not claiming here that "v" is universally weak, only illustrating that it **can** be. In French, ' can be the head of a branching onset as in "vrai" 'true', which suggests that the French "v" is **not** harmed.

As CG involves the loss of the two elements  $H^+$  and  $h^0$ , the decomposition of a "t" undergoing gradation to "d" can be represented as:

(12)



The output form is a neutral, coronal stop "d"; what has been described as a 'weak stop' in the literature (Holman 1984, Karlsson 1982, etc). Unlike the CG of "p", the output form in this case is, perhaps surprisingly, not a glide. The only way to account for this is to look at the difference between the  $R^0$  and  $U^0$  elements. The  $R^0$  cannot occur in a nuclear position, unlike  $U^0$  which occurs both in onsets and nuclei. This property of  $R^0$ , its 'consonant'-like nature, may contribute to the realisation of  $R^0-?^0$  as "d" rather than as a glide.

The third of our simple gradation cases, that involving "k", is somewhat different. In figure (10) we see that two elements remain. This is in contrast with the  $k \rightarrow \emptyset$  alternation illustrated by the data in (2b). The cold vowel represents nothingness (cf Chapter One) so we expect to find "?" as the gradated form of "k".

The output segment of such a lenition would be empty headed. (Velars have  $v^0$  as their head). Many languages do not license empty headed neutral onsets. Consider Turkish consonants: they are always devoiced in final position and hence have a representation which includes  $H^+$  and  $h^0$ , and negative charm (Gibb 1989). In medial position the neutral

version of any devoiced stop shows up; except for "k" - which alternates, as in Finnish, not with "g", but with 0. Thus we find alternations such as <gerek> 'necessary' and <gerei> 'necessary, (possessive)', but <at> 'horse' and <adi> 'horse, (genitive)'. Finnish, like Turkish, does not license empty-headed neutral segments and the output of the gradation of "k" is 0.

### 3.3 THE NATURE OF THE CHANGE: Sequences

#### 3.3.1 SEQUENCES WITH "K"

Having considered the cases of simple alternations we now turn to apparent sequences, which I propose to show to be identical in their behaviour. In (2a) and (2b) above, the lenition process occurs with the right point of our apparent sequence undergoing gradation, so that "lp->"lv" just as "p"->"v" and "lk" ->"l0" just as k->0.

(13)

"palkon"> <palon>

O	N	O	N	O	N	O	N
x	x	x	x	x	x	x	x
p	a	l		0	o	n	
				k			

The apparent sequence "lk" in (2b) behaves predictably, with the "k" preceded by the "l" becoming null after CG has taken effect just as the "k" in <aion> (1c) does.

The sequence "lk" however, as illustrated in (2c), can also alternate with "lj" in a way that a simple "k" cannot alternate with "j". The reason for this lies in the governing relations between the points in the syllabic string. This will be discussed in detail in the next section, so we shall concentrate for the present on the nature of the "lj" alternation and leave discussion of why it occurs for the appropriate section.

The "k"/"j" alternation occurs only when the vowel following the gradated stop is a front vowel, i.e. a vowel which contains the element  $l^0$ . The element  $l^0$  when it occupies an onset position is realised as "j". The realisation of the skeletal point which has contained "k" is the result of the spreading of the  $l^0$  element from the following nucleus into the onset which has become empty (as it does in the single "k"/0 alternation) after CG. This is illustrated as follows:

(14)



The segment "j" has the element  $l^0$  as its head. I will claim that in order to spread into the head position the  $l^0$  must be the head of the source segment. The vowels of Finnish which trigger  $l^0$  spreading from the nucleus to the onset will be those which have  $l^0$  as head.

### 3.3.1.1 Finnish Vowel Harmony

Finnish has five front vowels; that is five vowels which contain the element  $l^0$ . Three of these five vowels - "y", "ö" and "ä" - play an active role in Finnish vowel harmony. Their representation is shown in (15):

(15)



The remaining two Finnish front vowels are "i" and "e". They are neutral with regard to harmony and occur with both front and back vowels:

(16)



Our claim that the  $I^0$  element spreads into the head of an onset position when it is the head element of the source nucleus predicts that the "I0" > "Ij" should occur when the vowel immediately following is "e" or "i", the two Finnish vowels which have  $I^0$  as head. Finnish vowel harmony involves the spreading of the  $I^0$  element from the operator position, and so the vowels which trigger vowel harmony (those in (15)) should be exactly those which do not appear in the "Ik"/"Ij" alternation.

The sequences which should exist with the "Ij" gradation form of "Ik" are "Iji" and "Ije". However the sequence "ji" is impossible in Finnish initial position<sup>31</sup> (Hakulinen, 1961) - that is to say "i" cannot follow "j". Thus we should find "Ike" -> "Ije", but not "Iki" -> "Iji", given the constraint against such a sequence.

<sup>31</sup>Polish is similiar in this respect. (Jonathan Kaye, personal communication).

We find that the  $l^0$  spreading process occurs when the position which is empty after CG is followed by an "e". It is interesting to note that this spreading of  $l^0$  is in keeping with the general tendencies of Finnish harmonic processes. Finnish vowel harmony is a front harmony (i.e. one which involves the spreading of  $l^0$  as mentioned above). The  $U^0$  element does not spread in vowel harmony and "lk" does not alternate with "lw" before round vowels.

### 3.3.2 THE OBLIGATORY CONTOUR PRINCIPLE

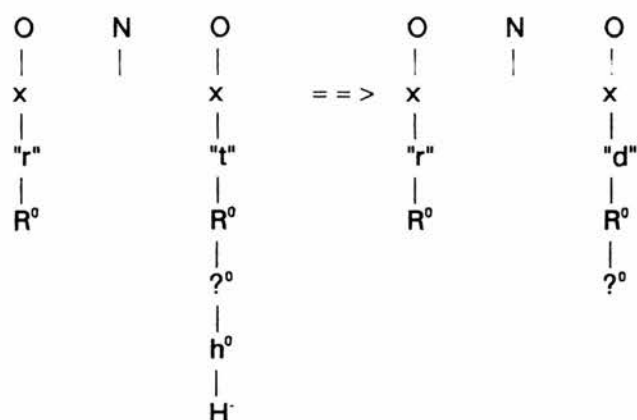
#### 3.3.2.1 Liquids + "t"

We now turn to the liquid + "t" cases. The data in (2d) and (2e) appear on the surface to show different output forms from the t/d alternations in the single cases. Instead of the "rt"->"rd" and "lt"->"ld" output, which we expect, we find "rt"->"rr" and "lt"->"ll". These alternations must be seen in the context of the nasal + stop cases of (3), where similar assimilation effects can be observed. A perusal of these examples seems to show that such effects occur only when the onset which is the prospective subject of CG is followed by an onset whose segmental structure is sufficiently similar.

Consider the alternation "rt"->"rr". The pseudo-sequence "rp" becomes "rv", as "p" gradates to "v". I have claimed that gradation in apparent sequences is the same as gradation in simple cases. The lenition of "rt" should consequently be such that "rt"->"rd" just as "rp"->"rv" and "t">"d".

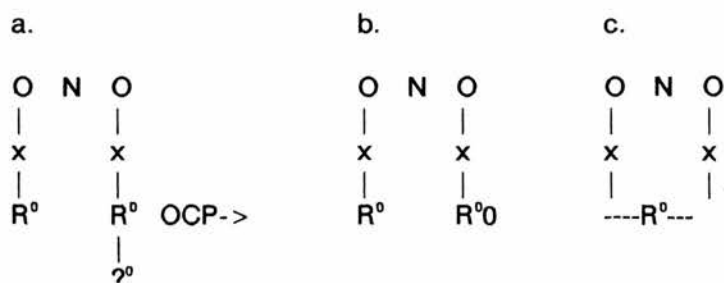


(17)



The application of the Obligatory Contour Principle (OCP) (cf. Chapter 1) prevents any two segments from sharing a parametrically specified number of identical elements. The position occupied by the "t" has lost segmental material. If the new segmental content triggers an OCP violation, the content will be deleted and segmental material from the preceding onset will spread into it, thus binding the two positions:

(18)

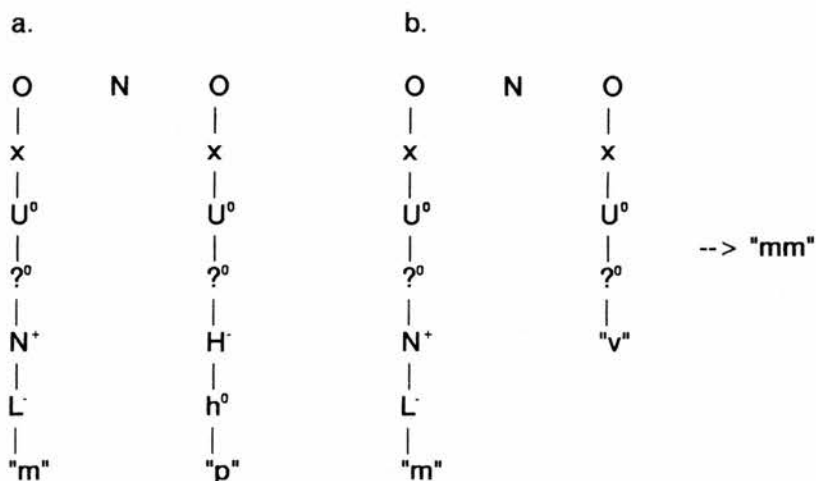


This being the case, it follows that what remains for us to do is to define the circumstances under which such an OCP effect is triggered in Finnish.

### 3.3.2.2 Nasals + Stops

In the nasal+stop cases assimilation occurs, so that <kampam> is realised "kammam". The heads of the segments which undergo assimilation are the same as they are in (18) above.

(19)

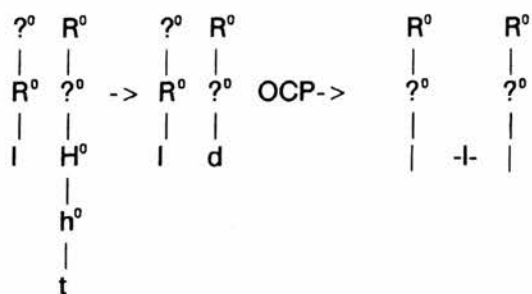


It is only after CG has reduced "mp"->"mv" and "rt" ->"rd" that the OCP takes effect. It appears that the charm which is present before CG prevents application of the OCP. We can state that the parameter defining the application of the OCP in Finnish will be operative between constituents which are adjacent (at some projection), and neutral with respect to charm.

In the examples above, the head elements of the two segments which undergo assimilation are identical. It is shown in (20), however, that  $R^0$  does not have to be a head to trigger OCP between neighbouring segments.

(20)

"It" -> "Id" -> "Il"



Summarizing, we can say that:

(21)

The Obligatory Contour Principle will be operative between neutral, adjacent segments which are bound.

Such binding will occur between:

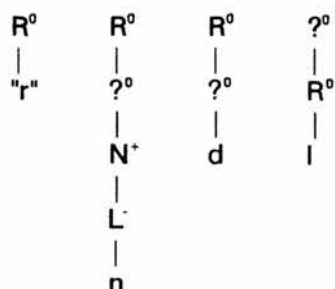
1. Any like-headed neutral segments.
2. Any segments containing the element  $R^0$ .

These adjacent segments must meet a further condition that will be expounded in my final version of the OCP in (26), below.

### 3.3.3 THE OCP IN FINNISH

The following representations illustrate the neutral  $R^0$  segments of Finnish:

(22)



This predicts that all of the following twelve configurations should be illicit pseudo-sequences in native Finnish words:

(23)

"rn"	"rd"	"rl"
"nr"	"nd"	"nl"
"dr"	"dn"	"dl"
"lr"	"ld"	"lr"

Of the configurations in (23) we have seen that "rd" and "ld" trigger OCP, yielding "rr" and "ll" respectively. All of the other clusters cited are ill-formed in Finnish with one exception, the first pseudo-sequence of (23), "rn". Our statement of (21) is in need of still further constraint. To consider the nature of this refinement we must look at the representation of the pseudo-sequence "rn":

(24)



In keeping with our original claim of (21) the sequence "nr" is illicit. This implies that "n" is able to relate to "r" in a way that "r" cannot relate to "n". In (24) above, "n" is more complex than "r"; thus it seems that "n" is able to govern "r" because of its complexity, and so prevent application of the OCP. The sequence "rl", however, is also illicit:

(25)



The segment "l" is not complex enough to govern "r", but "n" is. The "n" has a complexity structure which is two elements greater than "r". The "l" has only one element more than "r". For a governing domain to be set up, which prevents application of the OCP, the right point of the CC pseudo-cluster must have a complexity value which is two elements higher than the point to its left.

I can now propose a conclusive statement of the application of the OCP in Finnish:

(26)

The Obligatory Contour Principle will be operative between neutral, adjacent constituents which are bound.

Such binding will occur between:

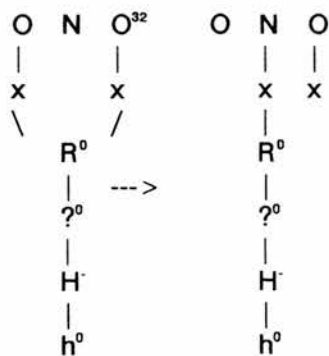
1. Any like-headed neutral segments.
2. Any segments containing the element R<sup>0</sup>.
3. Any sequence of segments where the right point does not have a complexity value which is more than one element greater than the left.

We have looked at the nasal and liquid + stop cases by discussing the application of the OCP. The remaining sequences are the "h" stop sequences of (4). Both "ht" and "hk" behave in accordance with our hypothesis that single and apparent cluster cases are in fact identical, so "ht" > "hd", just as t > d.

### 3.4 THE NATURE OF THE CHANGE: PSEUDO GEMINATES

Having accounted for all the cases of qualitative gradation, we must turn our attention to the quantitative gradation cases of (5), those which involve gradation of a geminate. As I claim that the actual nature of the gradation process is constant and that it is the right point which undergoes lenition in, for example, "hk" > "h", it follows that geminate gradation should similarly show the loss of the segmental material associated to the right point. The lenited forms of the geminate do not undergo further lenition themselves, so "tt"->"t", but the "t" does not then go on to gradate to "d" as a simple "t" would. This can be explained by supposing that the lenition involves the deletion of the segmental material from the right point without the deletion of the point itself:

(27)

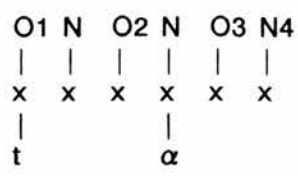


The retention of the right point after gradation means that the left point is not subject to gradation. The (now empty) right point intervenes between the left point and the onset-empty nucleus sequence which we have said follows a CG affected onset, as shown in (28):

---

<sup>32</sup>The representation of a geminate is shown here with an intervening nucleus. This is consistent with our initial statement as to the lack of branching constituents in Finnish and will be discussed more fully in the next section.

(28)



In (28), O2 has no segmental content as the onset immediately following (O3) is licensed by an empty nucleus (N4). The point O2, remains and as this is followed by a full nucleus (shown as α) O1 is not in a CG environment and cannot gradate.

Gradation in the quantitative sense then can be seen as identical to gradation in the qualititative sense with processes which involve the deletion of segmental material without the deletion of the skeletal point previously associated to it.<sup>33</sup>

3.5 THE TRIGGERING STRUCTURE

Having considered the segmental change to segments which have undergone CG, we move on to look at the nature of the segments which appear to trigger it. The triggering segments of CG are not restricted to any particular class; but rather they have a common link in so far as they hold certain positions on the phonological string.

Let us consider the syllabification within Government Phonology of the first example cited above:

<sup>33</sup> The "lk" to "lj" illustrate that in the case of "k" the point is retained after gradation. Otherwise here would be nothing for the l element to spread into.

(29)

"papun" < "pavun"

a.

O	N	O	N
x	x	x	x
p	a	p	u

b.

O1	N	O2	N	O3	N
x	x	x	x	x	x
p	a	v	u	n	

In (29a) there is no consonant gradation and the "p" remains as a "p". In (29b), CG does occur and the output form is "pavun". What is the difference in the structure of these two forms? From (29b) we can see that the onset immediately following the gradated onset, O2, is followed by an empty nucleus. We can recall the figure in (6), repeated here for convenience:

(30)

O1*	N1	O2	N2
x	x	x	x
x	y	z	

\*denotes gradation site.

Formally, I claim that:

(31)

If O1 is an onset and the following onset, O2, is licensed by an empty nucleus, then O1 will undergo consonant gradation.



If we assume that the CG environment is such that the onset which gradates has a following onset which is followed by an empty nucleus, we are faced with certain consequences for Finnish syllabification. These consequences will become apparent in the next section, where we consider the nature of the process.

Other phonological theories do not recognise the presence of a final nucleus as required by coda licensing (Kaye 1990). It is understandable that previous analyses have mistakenly assumed that the CG trigger involves some kind of closed syllable effect. The claim here is that whenever an onset is licensed by an empty nucleus the preceding onset will lenite.

### 3.5.1 SOME APPARENT EXCEPTIONS

Before we go on to discuss Finnish syllable structure and the nature of the CG process it may be prudent to consider some well-known exceptions to the environment as seen above in (30). These are the cases of so-called 'ghost' or 'fleeting' consonant (Keyser & Kiparsky 1984).

Certain kinds of word appear to show gradation even when the environmental conditions have not been met. These are the first infinitive (see (32a) (Keyser & Kiparsky 1984:18)), the negative forms, (see (32b)), and the 2nd person singular imperative, (see (32c)), of all verbs; as well as all words whose finally realised nucleus contains the vowel "e", (see (32d)).

(32)

- a. "saada" <saata> 'to recieve'  
"tehda" <tehta> 'to do, make'
- b. "en ha0e" 'I don't search' (from <hake> 'search')
- c. "ehdi" 'have time' (from <ehtia> 'to have time').
- d. "taide" <taite> 'art'  
"side" <site> 'bandage'

Consider "side" 'bandage'. One would normally assume that the syllable structure of this form is:

(33)

O1	N	O2	N
x	x	x	x
s	i	t	e

The "t" occupying the O2 position is NOT followed by another ON pair where the nucleus is empty. The condition in (30, 31) is not fulfilled. CG should not occur and we should find the form "site"\* rather than "side". The only way to derive "side" is to assume that the structure of "side" is not that which is depicted in (33). The syllable structure, rather, should look something like this:

(34)

O1	N	O2	N	O3	N
x	x	x	x	x	x
s	i	t	e	Z	

O3 is seen as being occupied by Z, where Z represents some segmental material which is attached to the point. This structure (34) would satisfy (30, 31) and the lenition of O2 to "d" would be predictable. It remains to justify the existence of O3 and to identify the possible nature of Z.

Interestingly enough it is this very same group, the group illustrated in (32), which shows the well known Sandhi phenomenon whereby any onset following will have a replica of itself added to the preceding word (Keyser and Kiparsky 1984, Cathey and Wheeler 1986). Thus for example <en hae kirjan> 'I don't search for the book' is realised as "en haek kirjan".<sup>34</sup>

In order for segmental material to be realised in this way it is necessary that a point exists for the material to fill.

(35)

O1	N1	O2	N2	O3	N3		O4	N4	O...
x	x	x	x	x	x		x	x	x
h	a		e		<- <-		k	i	r...

In (35) above, the "k" of O4 can only spread into the O3 position because there is an empty onset in the O3 position for it to spread into. The empty onset, O3, is itself licensed by N3, an empty nuclear position. Such forms would meet the environmental requirements and we would expect gradation to occur as it does in the data in (32). Fleeting consonants from

<sup>34</sup> Keyser & Kiparsky (1984) propose the existence of an empty c slot in the first infinitive cases of (32a). This slot is seen as a morpheme final c, which has no independent segmental content but which enables them to create the closed syllable environment which they see as a trigger for CG. My analysis is indebted to this original proposal.

following onsets can provide segmental content for these empty positions when they are there to do so. We can state that the O3 in (34) is empty and that the nature of Z is variable depending on what material from a following onset is available to it.

In this section we have looked at the following:

1. The nature of segments which can undergo CG. These are segments containing H, specifically "p", "t", "k". "s" is exceptional with regard to undergoing CG in that it contains H yet is invulnerable to the process. The reasons for this will be discussed in a following section.
2. The formal nature of CG is a lenition process involving the loss of h<sup>0</sup>, the noise element. As H cannot exist without h<sup>0</sup> in Finnish it too is removed as the result of CG.

3. The context of CG is:

O1*	N1	O2	N2
x	x	x	x
w	y	z	

(where O1\* is the lenition site and N2 is empty.)

We will now assemble these observations in such a way that our aim of an explanatory account of CG in Finnish can be achieved.

### 3.6 FINNISH CONSTITUENT STRUCTURE

In order to continue our discussion of CG and the environment where it occurs we must consider some general properties of Finnish. With this in mind we now look at some of the parameter settings for Finnish grammar.

#### 3.6.1 THE LICENSING OF FINAL EMPTY NUCLEI

Firstly, does Finnish license final empty nuclei? In languages where word final empty nuclei are licensed, such as English, French and Arabic, certain facts can be observed. Few or no constraints restrict which kind of consonants can occur in word final position and usually the onset which is licensed by the final nucleus can itself license a rime. Generally, in such languages, an onset which is licensed by a word final empty nucleus, is the same as an onset which is licensed by a normal nucleus.

In languages with no final nuclear licensing, such as Portuguese and Italian, the consonants which can occur in final position are rare<sup>35</sup> or non-existent, and there are no trans-constituent sequences in final position. Thus "vest" would not be a possible Italian word but is perfectly well-formed in English.

In Finnish, a highly restricted set of consonants can occur word finally, specifically all and only the segments which contain the element  $R^0$ . Possible reasons for this restriction will be discussed in the next section. Table (36) shows the possible word final consonants in Finnish with examples.

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<sup>35</sup>For example the consonants which can occur in Italian, in the few words where there are final consonants such as <per> 'through' <il> 'the', are consonants containing the element  $R^0$ .

(36)

"t"	<pidot>	'feast'
"s"	<ulos>	'out'
"r"	<auer>	'haze'
"l"	<askel>	'step'
"n"	<sievoinen>	'handsome'

Moreover Finnish has no word final clusters, either real or apparent, which (as will be shown later) follows partly from the fact that Finnish has no branching rimes.

It appears that Finnish has much more in common with the second group of languages described; that is, those which do not license word final empty nuclei. Accordingly, I will claim:

(37)

PARAMETER ONE  
Finnish does not license final empty nuclei.

3.6.2 PROPER GOVERNMENT

This claim may lead us to have certain expectations about Finnish. We expect all consonants to be followed by a filled nucleus which can act as a licensor. The words in (36) have shown us that this is not the case in Finnish, and that Finnish, like Italian, does permit certain consonants to occur word finally. Consider <ulos> 'out':



$\alpha$  properly governs  $\beta$  iff

1.  $\alpha$  is adjacent to  $\beta$  at some level of projection
2.  $\alpha$  is not itself licensed
3. No governing domain intervenes between  $\alpha$  and  $\beta$ .

Applied to (40) above we see that N2 can properly govern N3 because:

1. The two nuclei are adjacent at the level of nuclear projection.
2. No governing domain intervenes between them.
3.  $\alpha$  is a fully fledged nucleus, and not itself licensed.

In the theoretical literature cited, most proper government has been seen as operating from right to left, although provision was made for the parametric nature of its directionality in KLV 1991:291. Strict Directionality applies only to constituent or inter-constituent government; with the directionality of projection relations being parametrically specified for each language. Thus, just as with other inter-nuclear interactions such as vowel, harmony, stress and tonal phenomena, the directionality of proper government is parameterized.

Let us consider the implications of (39). Firstly, Finnish should have no initial pseudo-sequences. It will be shown that Finnish has no branching rimes.<sup>36</sup> A language

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<sup>36</sup>Two points will serve as illustration that this is the most logical initial position to take with regard to Finnish syllable structure.

1. Long vowels and diphthongs freely occur before the sequences which could be described as rime-onset configurations, e.g. <päästää> 'to let go' <täältä> 'from here'.

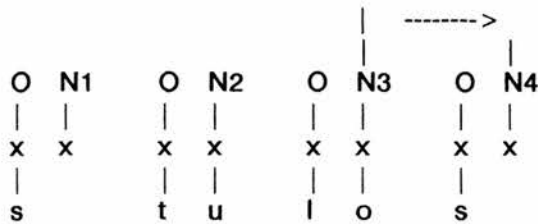
2. There are no final bi-consonantal sequences (e.g. \*tant). If Finnish nasal/liquid stop sequences are rime and onset, one would have to claim that Finnish final empty nuclei did not license preceding onsets to govern rimes (Charette 1991). There are however many cases where internal empty nuclei would have to license an onset to govern a rime. In <pankko> 'bank' the empty nucleus between the <kk> would have to license the <k> to be a governor. This would mean that



without branching rimes cannot have branching onsets (KLV 1991, Kaye 1991). It follows that any initial CC would have to be syllabified as having an intervening empty nuclear position, i.e. C0C where the intervening position was properly governed. However Proper Government, as has been stated, is left to right in Finnish; therefore no proper governor would be available to any such empty nucleus sandwiched within a pseudo-cluster in initial position. Any apparent <st>, for example, would in reality be syllabified as s0t and would have to be preceded by a full blown nucleus which could act as a licenser to the empty position.

(42)

\*\*"stulos"



In (42), it is clear that while N3 can license the final nucleus N4, there is no available nuclear material to the left of N1 which could license it to be empty, thus rendering such forms illicit.

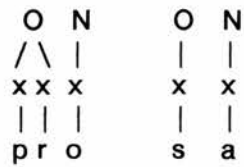
This prediction is true for native Finnish words. All such putative initial sequences occur in loan words, for example <stipendi> 'stipend', <proosi> 'prose', etc. It seems likely that loan words are in fact borrowed with their own native constituent structure. This

---

Finnish differed from all other cases of government licensing in the literature in that internal nuclei could license to govern but licensed final empty nuclei could not.

means that there is no need to insert some arbitrary marker to indicate when to turn off proper government but rather that proper government will find no empty category on which to operate in forms which come with their own (native) syllable structure. Consider for example <proosa>:

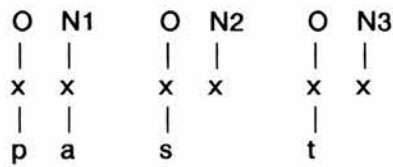
(43)



The intial branching onset of the English 'prose' comes with the word and thus there is no empty category in need of proper government.<sup>37</sup>

The second prediction to which we are led by our claim about non-final nuclear licensing and the directionality of proper government concerns final pseudo-clusters. Let us look at the illicit form \*<past>.

(44)



<sup>37</sup> If loan words have different constituent structure but proper government is constant our analysis of consonant gradation (which will be shown to depend crucially on certain proper government application) predicts that true consonant clusters in such loan words will not cause gradation. This is true as can be observed in a form like <verteks>,\* <verreks>.

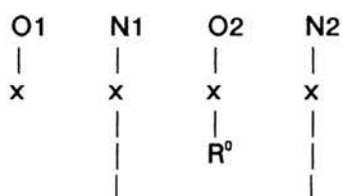
At first glance it seems as if N2 can be properly governed by N1 which is to its left and fulfils the necessary requirements of a proper governor. However, we have stated that nuclei such as N3 cannot be licensed by virtue of their word final position. N2 must itself be licensed (by N1) and as a licensed position is not a potential proper governor of N3. Thus this form must be deemed illicit and we predict no final apparent clusters in Finnish. This is correct for native Finnish words.

### 3.6.3 CONSTRAINTS ON LICENSING BY AN EMPTY NUCLEUS

Given that we have stated that only coronals can occur word finally and that word final nuclei are only licensed by proper government, two possibilities exist as to the  $R^0$  constraint on the consonants which can occupy word final position.

1. Only onsets containing  $R^0$  can be licensed by empty nuclear positions (or)
2. The only segment which can intervene between two nuclei if they are to have a proper government relationship is a segment which contains  $R^0$ , as shown in (45):

(45)



It seems unlikely that the second possibility is viable, given that proper government between nuclei happens on a nuclear projection where the nuclei are adjacent. It is equally unlikely that a segment which occupies an onset would be visible to two such nuclei at that level of projection. If we assume that for some unknown reason only coronals can be

licensed by empty nuclei, and that, as stated, Finnish has no branching rimes, then two predictions follow:

1. All internal C1C2 clusters are really sequences of ONO where N is empty.
2. Given that this intervening N is empty and only coronals can be licensed by empty positions, it follows that C1 must be coronal.

(46)



### 3.6.4 POSSIBLE BI-CONSONANTAL PSEUDO-SEQUENCES

Let us now look at the possible bi-consonantal pseudo-sequences in Finnish<sup>38</sup> (from Hakulinen 1961).

(47)

(a)

"tk"	<matka>	'travel'
"ts"	<katso>	'look'
"tr"	<katras>	'flock'
"tv"	<latva>	'treetop'
"tj"	<lotja>	'barge'

<sup>38</sup>As the nature of apparent geminates in Finnish was discussed in the last section they have not been included in this part of the analysis.

(b)

"sp"	< piispa >	'bishop'
"st"	< vasta >	'only'
"sn"	< kasna >	'wart'
"sl"	< kaisla >	'reed'
"sv"	< rasva >	'fat'

(c)

"lp"	< halpa >	'cheap'
"lt"	< ilta >	'evening'
"lk"	< polku >	'trail'
"lm"	< ilma >	'air'
"ls"	< tylsa >	'dull'
"lh"	< sulho >	'bridegroom'
"lv"	< polvi >	'knee'
"lj"	< hiljaa >	'quiet'

(d)

"rp"	< korpi >	'forest'
"rt"	< kerto >	'tell'
"rk"	< pyrki >	'strive'
"rm"	< sormi >	'finger'
"rn"	< torni >	'tower'
"rs"	< varsi >	'colt'
"rh"	< tarha >	'garden'
"rv"	< arvo >	'rank'
"rj"	< kirja >	'book'

(e)

"mp"	< kampa >	'comb'
"nt"	< hinta >	'price'
"nk"	< hanki >	'snowcrust'
"ns"	< kansa >	'folk'
"nh"	< vanha >	'old'

(f)

"pt"	< apteeki >	'pharmacy'
"ps"	< lapsi >	'child'
"pl"	< kupla >	'bubble'
"pr"	< kupru >	'bump'

(g)

"ks"	< laakso >	'valley'
"kl"	< sukla >	'chocolate'
"kr"	< kekri >	'a public holiday'

(h)

"ht"	<vihta>	'birch switch'
"hk"	<vihko>	'notebook'
"hm"	<lehma>	'cow'
"hl"	<kihla>	'engagement'
"hr"	<kehra>	'spindle'
"hj"	<pohja>	'bottom'

Groups (47 a-d) meet our initial constraint in so far as the first C of all these apparent CC clusters does in fact contain the element  $R^0$  and could therefore be licensed by the following empty nucleus. It will be shown in the next section that the data in (47e) also meet this requirement, with the nasal in forms such as <kampa> being underlyingly of the  $R^0$  class. This leaves groups (47f-h) for consideration.

We have noted that only  $R^0$  segments can occur in the onset before the final empty nucleus of a word. The initial segments of the pseudo-clusters in (47 f&g) cannot occur in word final position. Accordingly, I will claim that:

(48)

Non-coronal onsets which are followed by an empty nucleus must be licensed by a following onset.

(49)

O	N	O
x	x	x
$\alpha$		$\beta$

In (49) above a non-coronal  $\alpha$  must be followed by  $\beta$  where  $\beta$  is a filled onset. A further examination of the data in (47 f&g) shows (48)to be in need of refinement. All of the onsets

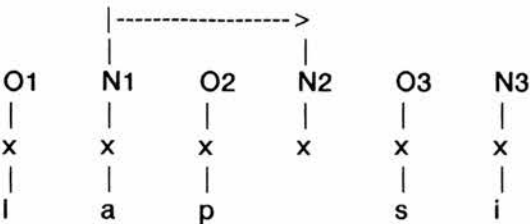
following the non-coronal segments are themselves filled by coronals and we can restate (48) so that:

(50)

Non-coronal onsets which are followed by an empty nucleus must be licensed by a following onset which is itself coronal.

Consider <lapsi>:

(51)



N2 is properly governed by N1. There is an empty nucleus separating O2 and O3. O2 is occupied by "p" which does not contain R<sup>0</sup>. N2 cannot on its own (because it is a licensed empty nucleus) license O2 which does not contain R<sup>0</sup>. However the following onset, O3, is "s", which does have R<sup>0</sup> in its representation, and therefore the "p" is licensed into O2.

### 3.6.4.1 The Condition

This should mean that in every C1C2 sequence either C1 or C2 or both should be a member of the class of segments which contain R<sup>0</sup>. This brings us to (47 h) where we find the only counter-examples to our claim. The segment "h", as expected, does not occur

before a final empty nucleus, therefore our original hypothesis that all non R<sup>0</sup> onsets must be licensed by a following onset still holds true for these sequences. From the data, however, we can see that no constraint operates on the nature of the segment which can license "h" into a pre-empty nuclear position. Thus we must finally revise (50) and claim that:

(52)

All non-coronal onsets (except "h") in pre-empty nuclear position must be licensed by a following onset which is itself coronal. The segment "h" in pre-empty nuclear position can be licensed by any following onset.

The totality of possible pseudo CC clusters in Finnish then is such that either one of the two must be a member of the R<sup>0</sup> class or the first C must be "h".

### 3.6.5 THE SIZE OF PSEUDO-CLUSTERS

Having considered the nature of segments which we can find in pseudo CC sequences we will now look at constraints which dictate the actual number of C we can expect to find in any consonant configuration, given our proper government analysis. The first prediction would appear to be that any apparent internal clusters should be maximally binary and a form such as <markka> 'mark' should be impossible.

(53)

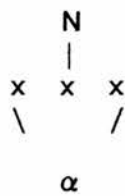
O	N1	O	N2	O	N3	O	N4
x	x	x	x	x	x	x	x
m	a	r		\	k	/	a



In (53), we can see that while N1 is available to properly govern N2, there is no proper governor for N3, as was the case in (47). However, a form with this structure is not impossible in Finnish, but is in fact common.

Let us assume that N1 is properly governing N2. It remains for us to find a licenser for N3. As was suggested in our consideration of Icelandic in Chapter One, a segment which is doubly linked constitutes a domain which will license any empty nuclear position contained therein (Kaye 1991:322):

(54)



This refines our initial prediction to the effect that any medial sequence of three consonants should consist of some segment followed by an apparent geminate. This is closer to the facts of Finnish. Finnish does indeed contain many clusters of this sort:

(55)

- |                    |                        |
|--------------------|------------------------|
| <tulppa> 'stopper' | <limppu> 'rye bread'   |
| <pantti> 'pledge'  | <kartta> 'map'         |
| <pankki> 'bank'    | <tulkki> 'interpreter' |

Our prediction however is not refined enough, implying as it does that ANY consonant + pseudo geminate configuration should be well-formed in Finnish. This is demonstrably false as there are many of such predicted sequences which cannot occur; e.g. "tkk", "hkk" (Karlsson 1982, Karttunen 1970). We can immediately reduce the number of possible sequences by incorporating our earlier observation that empty nuclei only license

R<sup>0</sup> consonants. We have now reduced the predicted fake tri-consonantal sequences to the following:

(56)

C1	0	C2	0	C2
1. "s"	0	C2	0	C2
2. "t"	0	C2	0	C2
3. "r"	0	C2	0	C2
4. "n"	0	C2	0	C2
5. "l"	0	C2	0	C2

(where 0 = empty nucleus)

As can be seen from (55), the last three of these predicted configurations can occur; "r" C20C2, "n" C20C2 and "l" C20C2. Leaving aside the value of the variable C2, two problematic cases emerge: **"t" 0C20C2** and **"s" 0C20C2**, neither of which is attested in Finnish.

Let us look at the case of "s" and "t". Suppose we assume that the consonant occupying the c2 position must govern the consonant in the cluster-initial position. Concretely we can state that the governor must be negatively charmed and the governee must be neutral. The charmed segments of Finnish are "p" "t" "k" "s" as was seen in our earlier discussion of the Finnish inventory. From this it follows that neither "s" nor "t" could be the initial member of a tri-consonantal cluster because they contain the element H and are consequently not potentially governable. Of the coronals (recalling that only coronals can be licensed by the empty nucleus) only "r", "n" and "l" are neutral and so only these should occur as the initial member of a Finnish tri-consonantal pseudo-cluster. This is exactly correct.

Now let us turn to the value of c2. It should be stated at the outset that all of the following consonants can be geminate in Finnish (Karlsson 1982, Karttunen 1970):

(57)

"pp"	<oppi>	'learn'
"tt"	<aatto>	'evening'
"kk"	<lakki>	'cap'
"ss"	<pussi>	'bag'
"mm"	<tumma>	'dark'
"nn"	<pannu>	'pan'
"ll"	<hillo>	'jelly'
"rr"	<parru>	'beam'

Our analysis predicts that only geminates containing a charmed segment may occupy the latter two positions of a pseudo tri-consonantal sequence. We therefore predict the following totality of apparent consonant + geminate sequences in Finnish:

(58)

	P	T	K	S
R	rpp	rtt	rkk	rss
L	lpp	ltt	lkk	lss
N	npp	ntt	nkk	nss

These and only these are the well-formed consonant sequences consisting of an initial consonant followed by a pseudo-geminate. The one proviso which we need to add is that the nasal must agree with the following stop, which is not reflected in (58) above. We shall return to this point later.

### 3.6.6 GOVERNMENT WITHIN TRI-CONSONANTAL PSEUDO-CLUSTERS

Until now the precise nature of the governing relationships between members of the pseudo tri-consonantal sequences has remained unspecified.

Consider the form <matka> 'travel':

(59)

O1	N	O2	N	O3	N
x	x	x	x	x	x
m	a	t		k	a

There can be no governing relationship between the point with the "t" and that with the "k" since the "t", as stated previously, is negatively charmed and hence ungovernable. Yet in an illicit form such as \*<matkko> (60) we would require the "k" to govern the "t":

(60)

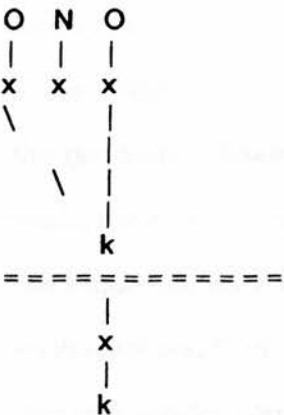
O	N	O	N	O	N	O	N
x	x	x	x	x	x	x	x
m	a	t		\	k	/	o

For this reason, (60) is illicit. Form (59) <matka> on the other hand is well-formed. The question is why the "k" in (60) tries to govern "t", while that in (59) does not. The answer is evident if we consider the fundamental difference between the role of the position governing "k" in each example.

In the former case (59) the "k" has no designated governing function while in the latter case (60) it is the head of a pseudo-geminate which we have stated above must be considered the head of a governing domain. More specifically I will state that the rightmost point of a geminate is the head of this domain. Government is manifested (as in Icelandic)

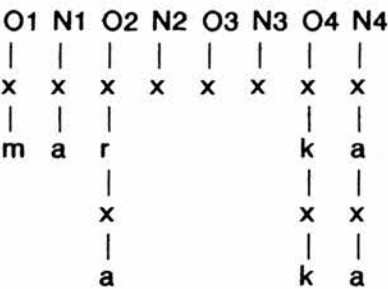
by the spreading of segmental material onto the governed point.<sup>39</sup> This means that as the head of the entire sub-domain only the rightmost onset will be projected.

(61)



Non-governors remain unprojected. Thus, inserting (61) into <markka> and projecting all material which has not itself been licensed gives us:

(62)



Only the licensors, N1, O4 and N4, are projected in (62) above. N3 is licensed by being contained within the "k" domain. O3 is the onset position governed by "k" while N2 is properly governed by N1. The "k" on this projection is adjacent to the "r"; more precisely

<sup>39</sup>Governing may involve the spreading of a whole segment onto the governed geminate point as in "kuppi" 'cup' or the spreading of part of the head as in the realisation "ku?pi".

no unlicensed material separates "k" from "r". The segment "r" is neutral and potentially governable, "k" is the head of the governing domain, and government between the "r" and "k" obtains.

This hypothesis enables us to correctly predict a fact we mentioned earlier, namely that any nasal in the initial position of a tri-consonantal pseudo-cluster has to be homorganic with the geminate following. Obvious cases of government, such as trans-constituent government, involving a nasal and an obstruent require homorganecity (i.e. "mt" is not a possible true sequence) (KLV, 1991). Having established that there is a governing relationship between the first and third members of our tri-consonantal pseudo-clusters we would expect to observe a similiar constraint of homorganecity in these cases, as indeed we do.

(63)

"kimppu"	*"kinppu"	'bundle'
"tanssi"	*"tamssi"	'dance'
"ki <sub>0</sub> kku"	*"kinkku"	'ham'

### 3.6.7 SOME OTHER TRI-CONSONANTAL PSEUDO-CLUSTERS

Our analysis has predicted all of the possible C1C2C2 clusters (Karlsson 1982) of Finnish, but this does not exhaust the totality of Finnish tri-consonantal sequences. The following pseudo-sequences are also observed in native Finnish words (Karttunen 1970):

(64)

"rst"	<pyrsto>	'fish'
"rsk"	<myrsky>	'storm'
"lst"	<palsti>	'plot of land'
"lsk"	<salskea>	'slender'
"nsk"	<ranska>	'France'

Two striking facts emerge from a consideration of (64):

1. The first element of the C1C2C3 sequence is a member of the R<sup>0</sup> neutral cases, as the first member of our tri-consonantal pseudo geminate sequences was.
2. C2 and C3 always belong to the set of segments which we have previously defined as being negatively charmed - "p", "t", "k" and "s".

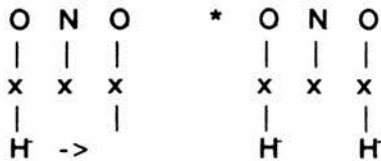
We may conclude that the second and third consonants are forming a governing domain just as in the pseudo-geminate cases. In the pseudo-geminate cases the c2 position was effectively empty, requiring the spreading of segmental material from the geminate head to create a governing domain in which the intervening empty nucleus could be licensed.

In the cases under present discussion there is autonomous segmental material to identify each of the skeletal points. A governing domain must be created for some reason other than in the pseudo-geminate cases.

### 3.6.7.1 H<sup>-</sup> Binding

Let us suppose that successive projected onsets form a governing domain if they are bound. Moreover, that such a binding involves a shared H<sup>-</sup> element.

(65)



The above formulation is immediately reminiscent of an OCP effect preventing the occurrence of two successive H<sup>-</sup> elements.

For consistency I will propose that the right member is the head of this domain as was the case in the pseudo-geminate examples of the previous section. Also, as in the pseudo-geminate cases, the head of the governing domain will be projected and will, of necessity, govern the C1 member of the sequence.

This proposal requires three things:

1. The C1 position must be governable, that is, neutrally charmed, and coronal, due to the constraints discussed earlier, which limit empty category licensing to R<sup>0</sup> consonants.
2. The consonant in the C3 position must be negatively charmed so that it can govern C1.
3. The consonant in the C2 position must likewise be negatively charmed in order to form an H<sup>-</sup> domain and thus give C3 access to C1.



The failure of any of the above conditions should result in an ill-formed tri-consonantal pseudo-cluster. Thus "pst"\* is ill-formed because "p" is negatively charmed and thus ungovernable by "t"; "rlt"\* is ill-formed because no domain is created between "l" and "t" and the intervening nucleus cannot be licensed; "rtl" is ill-formed for similar reasons, with the neutral "l" being unable to create a domain with the preceding "t". Referring to (64), the reader will note that these conditions are met by all of the native Finnish tri-consonantal pseudo-clusters.

### 3.6.8 SUMMARY OF FINNISH STRUCTURE

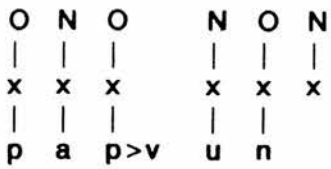
This completes our account of Finnish syllable structure and the apparent clusters which result from the various stipulations operating upon it. This analysis is completely consistent with our basic claim that Finnish proper government is left to right and that Finnish contains no branching rimes (and hence no true consonant sequences).

### 3.7 THE NATURE OF CONSONANT GRADATION

By amalgamating our discussion of the environment where the process occurs with our description of Finnish syllable structure we can look at the nature of the CG process. Recalling the earlier section on environment we may note that consonant gradation occurs when the onset following the effected onset is itself followed by an empty nucleus. Consider the following:

(66)

<pavun> 'bean, gen.'



(67)

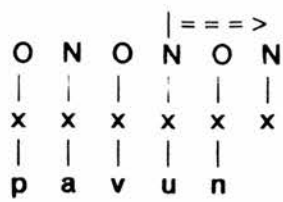
<pavusta> 'bean, elative'



In both (66) and (67) the "v" which is the lenited version of the "p" is followed by an onset which is licensed by an empty nucleus.

Let us look at (66) somewhat more closely. In the last section we stated that Finnish does not have the licensing of word final empty nuclei as a parameter. In consequence, all final consonants had to be followed by a nucleus which was licensed by virtue of proper government. Proper government was shown to operate in Finnish from left to right. In (66) above then the relationship at the level of nuclear projection is represented as follows:

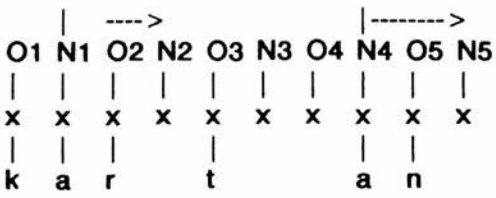
(68)



It becomes apparent not only that the following onset is licensed by a properly governed nuclear position but more importantly that **the onset which is gradated is followed by the nucleus which is itself the proper governor of the following nucleus.** Returning to (66), we see that the lenited onset is licensed by a nucleus which has to act as a proper governor to the following empty position.

Finally, let us look at one of our tri-consonantal pseudo-clusters undergoing gradation. <kartta> 'map' has the genitive form <kartan>. In the introduction it was shown that gradation involves the lenition of the rightmost point of a sequence (e.g <palko> 'buckle' <palon> 'buckle, gen.' \*<pakon>). The representation of <kartan> then should be:

(69)



The gradated point, O4 in this case, is followed by the nucleus (N4) which has to license the domain final position. Although the segmental material of the geminate is now associated to O3, the governing domain between the two x slots is retained, thus protecting the licensed intervening nuclear position (N3). The governing domain of the geminate slots

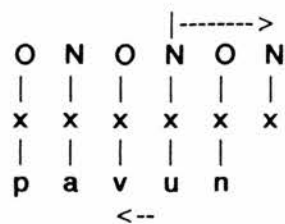
also protects the remaining "t" from further lenition as the nucleus following it is N3 (the licensed position) and not the licensee, N4.

Refining our earlier description of the consonant gradation environment, we can conclude that the onset which gradates is itself licensed by a nucleus which is, in its turn, a proper governor to a following empty nuclear position.

### 3.7.1 LICENSING ABILITY

I will claim that the inherent ability of any nucleus to act as a licensor to a preceding onset is fixed. Taking a word such as <papu> 'bean', we find that the "u" is licensing the preceding onset which contains "p". In a form such as <pavun>, however, this same nuclear segment not only has to license the preceding onset but in addition has to properly govern the following empty nuclear position:

(70)



In (70), we see the dual functions of the nuclear position containing "u", as licensor to the preceding onset and as proper governor to the following nucleus. Given my claim that the inherent governing ability of any segment is a fixed quantity, it follows that these two roles cannot be carried out independently of each other.

Specifically, the need to properly govern a following empty nuclear position will reduce the governing nucleus' power as a licensee to the preceding onset. We will formalize this reduced ability thus:

(71)

A nucleus which is itself a proper governor may not license a charmed onset.

Thus we find that instead of being able to license an onset containing a full-blown negatively charmed "p", our somewhat overworked nucleus is only able to license the gradated form, which has lost the H', and consequently its negative charm - that is "v".

In a form such as <karttan> the governing licenser "a" is unable to license the segmental material into the head of the geminate shown as O2 in (72) below. The substance of the pseudo-geminate then occupies the left point of the sequence, O1.

(72)

O	N1	O1	N2	O2	N3	O3	N
x	x	x	x	x	x	x	x
r		t			a	n	

The "a" is still able to license the rightmost (empty) slot of the sequence, O2, because it does not contain charmed segmental material; so the governing domain remains intact and protects the empty nuclear position, N2.

My claim that CG is the result of the reduced licensing power of the nucleus following the lenited segment brings me to make a certain prediction about the segment <s>. <s> is negatively charmed. We have stated that the result of CG is that the H element is lost, it might be expected that <s> would, in common with the other H segments, undergo CG. However there are other properties of <s> to take into account. Kaye (1992) claims that a neutral <s> can be licensed by any nucleus. If this is the case we would expect to find evidence of it in various languages. In the last chapter we considered Italian, let us again return briefly to look at the phenomenon of 's impuro' in Italian (this example is taken largely from KLV 1991<sup>40</sup>). Italian has two forms for the masculine definite article:

(73)

"il costo"	'the prince'	"l'arco"	'the arch'
"il sale"	'the salt'	"l'elenco"	'the list'

When the onset following the article is filled we find the <il> form, and when it is empty we find <lo>. An onset containing <s> behaves normally. However when we consider s+c+c clusters we find a somewhat different story with forms such as:

(74)

"lo straccio"	'the cloth'	"lo scuro"	'the darkness'
---------------	-------------	------------	----------------

This indicates that the <s> in such forms is not in an onset but in a rime. Such a rime is not supported by a filled nucleus, and thus we find a rimal <s> licensed by an empty nuclear position. Similarly in English only <s> can occur before branching onsets in forms such as <straight>, <sprite>, etc. Such an <s> must be syllabified into a preceding rime, a rime which is once again supported by an empty nucleus.

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<sup>40</sup>For further examples of "s" or 'magic' licensing, the reader is referred to Kaye 1992.

Given that a neutral <s> can be licensed by anything, and given that our CG effects are the result of a reduction in the licensing power of the licensing nucleus, it seems reasonable to suppose that Finnish <s> be immune to CG effects, as is indeed the case.<sup>41</sup>

Consonant Gradation is the result of the reduction of the licensing ability of the following nucleus. This reduction in ability occurs when the nucleus has to use some of its inherent governing properties to perform another function, namely to act as a proper governor to a following empty nuclear position.

### 3.7.2 THE IMMUNE CLUSTERS

There are clusters which remain immune to the consonant gradation process even when the requirements of environment described above are met. The genitive form of <matka> 'travel' is <matkan> and not <matan>\* as we might expect. The complete set of the clusters which show immunity to gradation are represented in (75):

(75)

"sp"

"st"

"sk"

"tk"

The reader will have noticed that these clusters bear more than a passing resemblance to those which appeared in our fake non-geminate tri-consonantal clusters of (64). More explicitly the sequences which do not gradate are all those where both onsets contain the H' element - that is where both onsets are negatively charmed. In an earlier proposal I claimed that a governing domain was set up as the result of binding between successive

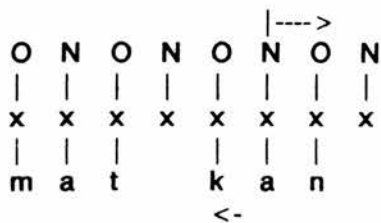
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<sup>41</sup> Note that I do not claim that the charmed, Finnish <s> can be licensed by anything, only, in accordance with Rhee (1991), that it may be easier to license than the other charmed segments. Finnish <s> does not show the 'magic' licensing effects (Kaye 1991) of the neutral <s>.

H elements. Extending this proposal, I will now claim that such a **bound domain** is in fact protected against the effects of consonant gradation.

Let us consider this idea in more detail. We have shown that CG is caused by a reduction of the licensing powers of the nucleus immediately following. In a form like <matkan> the "a" which is licensing the "k" also has to properly govern the empty position following the "n":

(76)



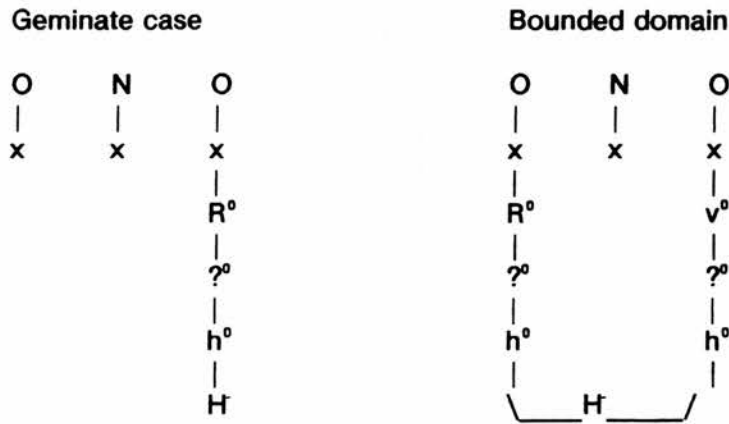
We might expect that the "a", which had previously only to license the "k", and which now additionally has to govern the following nuclear position, might be unable to license the "k" any longer. However, we have seen that the binding effect caused by two H elements results in the two adjacent onsets sharing an H element rather than retaining their completely autonomous segmental content. Thus the segmental content of the onset preceding "a" is not solely dependent on the licensing power of its nucleus, but also on the binding relationship it has with the preceding "t". The diminished licensing powers of the nucleus have no effect on the inter-onset relationship between the "t" and the "k" and so the loss of the H element does not occur.

The binding between the successive onsets occurs as the result of two autonomous segments sharing an H segment. It follows that geminates which have no segmental autonomy, no binding effect triggered by an OCP application, and a head whose content



is licensed solely by the following nucleus, should not be protected from such effects as consonant gradation. This, as we have seen, is the case.

(77)



That such binding is the result of a shared H<sup>+</sup> element and is not the result of some factor involving the h<sup>o</sup> element (which is also common to both members of all the clusters in (75)) is shown by the fact that clusters such as "hk" and "ht" do lenite. In such cases the first member of the sequence has h<sup>o</sup> but no H<sup>+</sup> and so, given our proposal, we would not expect any bound domain to exist.

In this sub-section we have considered those sequences which are immune to CG. It was shown that the common factor in all such cases is the presence of the H<sup>+</sup> element in the onsets of the immune cluster. I proposed that such cases have onsets which are bound by a shared H<sup>+</sup> element and that this binding renders them invulnerable to the effects of CG.

3.8 POSSESSIVES

In the previous section we looked at Finnish immune clusters, but in Finnish noun morphology there is also a set of affixes which, while apparently creating the environment of CG, do not trigger the process. Nouns which have a possessive suffix attached will not undergo gradation.<sup>42</sup> Let us consider the forms of the first and second person plural possessive and the most common form of the third person (singular and plural), all forms which we would expect to trigger CG.

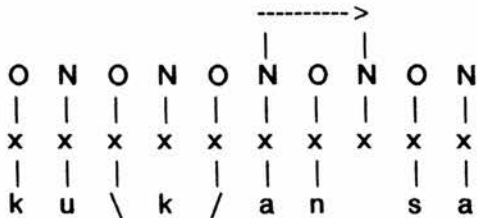
(78)

"kukka"	'flower'
"kukkamme"	1st person plural possessed form
"kukkanne"	2nd person plural possessed form
"kukkansa"	3rd person possessed form

Note that the expected gradation of "kk" to "k" does not occur in any of these forms in spite of the fact that the environment is that shown in (79), which we would expect to trigger gradation.

(79)

"kukkansa"



<sup>42</sup>Pierrehumbert (1980) and Nevis (1984, 1985) have claimed that the Finnish possessive forms act syntactically as clitics rather than affixes. The fact that their syntactic behaviour can merit such claims seems to support the notion that they are further removed from the head than other Finnish affixes.

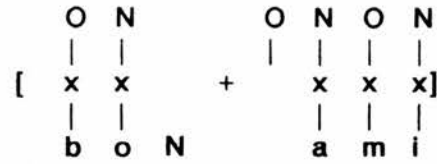


(81)

a. son ami

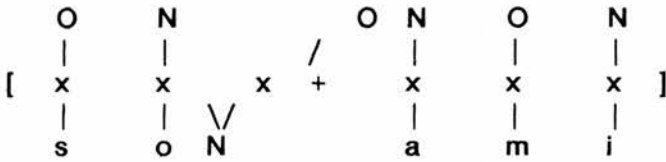


b. bon ami



The presence of this innermost domain meant that the N, as it were, 'performed' twice. In the innermost domain, no onset was available to it and so it associated to the preceding nucleus. In the outermost domain an onset was available and it also associated to that. The application of the SCC prevented the N from undoing the association it had made in the inner cycle, with the result that the form in (82) was created:

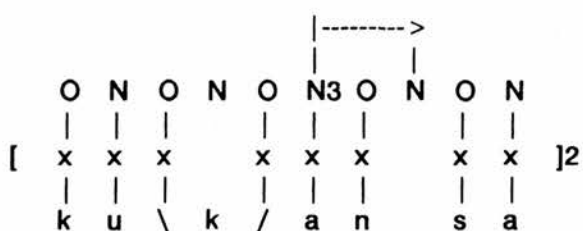
(82)



The Finnish morphology we have considered up to this point has been of the 'bon ami' type. No internal domains intervened between the affected segment and the triggering one. The 'kk' of 'kukalla' becomes simple because the nucleus licensing it has to properly govern the empty nucleus between the 'll' sequence. In the French <bon ami>, the empty onset following the floating N was always available to it; there was no inner domain within which a nuclear association had been necessary. Explicitly, in both <bon ami> and <kukalla> the floating segment and the governing nucleus respectively are operating within single domains. In (83) we see that the nucleus N3 has both to license the preceding stop and properly govern the empty nucleus within the one domain.



(86)



(87)

[[  
O N O N O N3 O N O N  
| | | | | | | |  
x x x x x x x x  
| | \ / | |  
k u k a]1 n s a]2  
<--|

166

onset and properly govern a following nucleus would have less licensing power than a nucleus which did not have to act as a proper governor. This analysis of the Finnish possessive form leads us to propose a refinement of that earlier claim such that:

(88)

The licensing ability of any segment is fixed for each domain in which it will do that licensing.

The application of this principle means that a nucleus which is using its licensing ability to properly govern a following nucleus will have less ability left to license a preceding onset. In the Finnish possessive case the two roles of the nucleus, licensor and proper governor, occur in different domains and are therefore independent of each other. The Finnish nucleus is able to perform both within and across separate domains.

### 3.8.2 DIFFERENT ROLES IN DIFFERENT DOMAINS

In the next chapter we will consider in detail some similar occurrences in the North Eastern Bantu language of Kikuyu. However, in order to pursue this present question of segments having roles in different domains, a brief consideration of some relevant Kikuyu facts is in order.

In Kikuyu, any domain initial "k" will become "g"<sup>44</sup> when the following onset contains a 'voiceless' segment.<sup>45</sup> The effects of this are visible between the initial onset of a root and a prefix so: <ka> + <tahi> "gatahi" 'little locust'; from prefix to prefix, as in <ka+ka+ko+-

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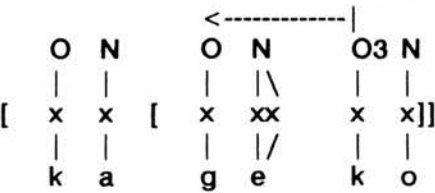
<sup>44</sup>The symbol "g" is used by me to denote the voiced velar fricative in Kikuyu.

<sup>45</sup>This is over simplifying on a point not particularly relevant to the current issue. For a detailed discussion the reader is referred to Chapter Four.

<ka+ka+ko+ke+hakera> "gagagokehakera" 'he painted it for you'; and from the initial onset of a root to any subsequent prefixes, as in <a+kaa+ke+ikia> "agaageikia" 'he will throw it'. Summarizing these facts then, we can say that the onset which triggers the transformation can operate across any number of domains.

In keeping with the nature of the process one also finds that a root form such as "keeko" ('geeko' 'pipe') is illicit. Such forms however do not cause any preceding onsets to lenite. The diminutive of "geeko" is "kageeko" **\*\*gageeko**". Explicitly, it seems that any onset which has triggered the transformation from "k" to "g" of any onset **WITHIN ITS OWN DOMAIN** will not trigger the process in any subsequent domains.<sup>46</sup>

(89)



In Finnish the nucleus of the possessive form was able to work both within (as a licensor) and across (as a proper governor) a domain. In Kikuyu we see that this is not the case, and that an onset having acted once within a domain may not also operate across it.

This difference can be captured in a parameter which states the abilities of constituents to govern both within and across domains as specified in (90):

<sup>46</sup> One possibility is that nuclei may perform both within AND across domains, while onsets may perform either within or across domains but not both. A fuller exploration of this would take us beyond the scope of this thesis but it is certainly an area for further consideration.



**In language X segments have the ability to perform their licensing roles both within and across domains. Yes/No**

One conclusion which can be drawn from this is that in languages where the parameter of (90) is set to YES licensors will have greater powers overall. This is not to say that it will affect the licensing ability within any domain, but that the overall work done by the nucleus in (91) below is ultimately greater than that done by the Kikuyu onset in (89), simply because the Finnish constituent has fixed abilities both within and across a domain.

[[  
O N1 O N2 O N3 O N4 O N5  
| | | | | | | | |  
x x x x x x x x x  
| | | | | | | | |  
k u \ k / a] n s a]  
| <-|  
1  
2  
----->

In this section we have shown how the behaviour of the Finnish Possessive can be explained by reference to its analytic nature. I proposed that the ability of segments to operate both within and across domains was subject to parametric variation. We saw that

Finnish had this parameter set to YES; Finnish nuclei could perform both within and across domains. The second "a" of <kukkansa> then is able both to license the rightmost "k" of the preceding pseudo-geminate and to properly govern the nucleus separating the "n" from the "s", because both duties occur in different domains.

### 3.9 FINNISH VERBAL MORPHOLOGY

As this analysis of consonant gradation uses examples largely drawn from Finnish noun morphology, we will now complete our account of CG by looking at verbal morphology. In marked contrast to Holman (1984, 1986, 1990) the stem posited for each verb will be seen to have the strong member of the consonant gradation alternation, i.e. the form which has not undergone CG. Holman (1984, 1990) argues that Class 3 stems have the weak member of the alternation in the stem which 'de-gradates' in given environments. Holman claims that these forms make it necessary to posit two gradation processes in Finnish: one which changes underlying t->d, tt->t, etc and another which changes d->t, t->tt. My study of Class 3 verbs shows that this additional process is not needed to account for these forms.

We adopt the system of verb classification proposed in Holman (1984, 1990). This classification divides verbs into four groups according to the infinitive form of the verb in question. This classification will be shown to be an inaccurate one but it will enable us to deal methodically with each kind of verb.

Of these four classes, Class 1 verbs have an infinitive which ends in a short vowel + ta/tä, e.g. <antaa> 'to give'. This is somewhat different from the other three groups, for reasons which will be explained and discussed at the end of this section.

3.9.1 CLASS TWO

Class 2 verbs have the infinitive marker *da/dä*. Some examples are given in (92):

(92)

<myydä> 'to sell'

<saada> 'to receive'

<tehdä> 'to do'

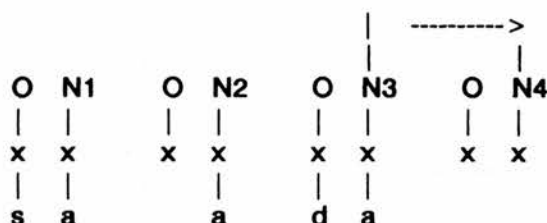
<uida> 'to swim'.

Let us consider the form <saada>. This consists of the stem <saa> plus the infinitival marker. We know from previous discussion that <d> in Finnish native vocabulary exists only as the gradated form of <t>. If we have <saa> + <ta> there is no obvious CG trigger and we expect the form to be realised "saata". As the output form is <saada>, we must show how consonant gradation has come to take place. Referring to our earlier discussion about the so-called 'ghost' consonant cases (where an empty onset existed which could be filled by segmental material from any following available onset) we see that the infinitive displays exactly these properties. Thus 'to receive a book' <saada kirja> is realised as "saadakkirja". This means that the <ta> suffix is followed by an empty onset which is in turn licensed by an empty nucleus. This structure may be represented:

(93)



(94)



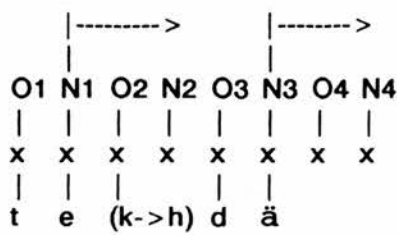
(95)



<sup>47</sup>The other verb is "nahdä" 'to see' which behaves identically to "tehdä".

<h>. As in other Class 2 verbs the N3 position has to properly govern the empty N4 position, with the result that it can no longer license the full blown "t" of O3, which lenites to "d". Thus we derive the correct output form <tehdä>:

(96)



This accounts for all Class 2 verbs. I now look at Class 3 verbs.

### 3.9.2 CLASS THREE

Holman (1990:3) describes Class 3 verbs as those verbs which have a consonant final stem and an infinitival marker of consonant +a/ä where the consonant must be coronal. Examples of Class 3 verb are shown in (97):

(97)

<purra>	'to bite'
<tulla>	'to come'
<mennä>	'to go'
<ajatella>	'to decide'
<pestä>	'to wash'

In order to deal with forms such as <ajatella> Holman (1990:3) posits a process of **inverse gradation**. Holman creates a stem by removing the Ca sequence which he claims to be the infinitive. This stem <ajatel> has a single "t". The first person is created with the addition of <en>. The "t" in this form is geminate <ajattelen>. Holman claims that a

process of inverse gradation operates on the <t> of <ajatella> to yield the form <ajattelen>. Explicitly, he states that "For verbs of type 3 gradation takes place stem internally from **weak to strong** [my emphasis]" (Holman 1990:5). My analysis will show that CG in Class 3 verbs is identical to CG in Classes 1 and 2.

I propose that the infinitive marker of Class 3 verbs is identical to Class 2 <sup>48</sup> and that the stem has the strong form of the CG alternation. This yields the structure <aja-ttel> + <ta>:

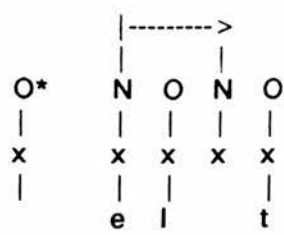
(98)

														----->	
N	O	N1	O2	N2	O3	N3	O4	N4	O5	N5	O6	N6			
x	x	x	x	x	x	x	x	x	x	x	x	x			
a	i	a	\	t	/	e	l		t	a					

The first empty nucleus is N2. We have shown that a nucleus contained within a doubly linked segment is licensed by its position and N2 is contained between a doubly linked "t". With the formation of the infinitive, however, the nucleus immediately following it, N3, has to act as a proper governor to the empty nucleus separating the "l" from the "t". The strained resources of the proper governor nucleus N3 can now no longer license the geminate and so gradation occurs as shown in (99) below:

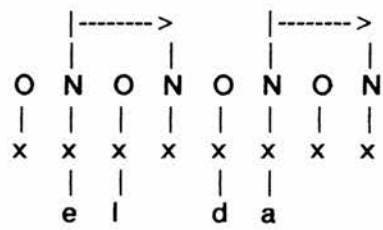
<sup>48</sup>Cathey and Wheeler (1986) also propose an infinitive form <ta> for Class 3 verb.

(99)



The expected form would now be \* <ajatelta> . There is, however, the empty nucleus of the infinitive, N6, which has to be properly governed. Its proper governor, the nucleus immediately to its left, is N5. N5 is no longer able to license a full blown "t" into O5 and so O5 gradates. The gradation of O5 results in the illicit sequence <lød> :

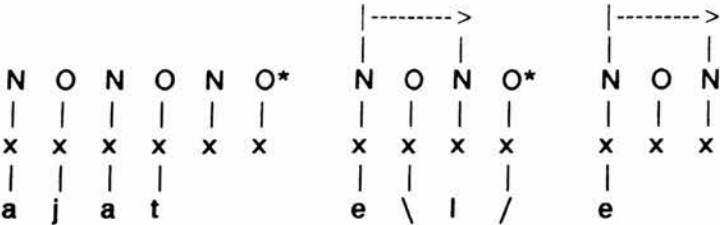
(100)



Earlier in this chapter we saw that the sequence <lød> violates the OCP as it applies in Finnish with the result that such sequences undergo further gradation to <løl> .

Form (101) <ajatelle> results:

(101)

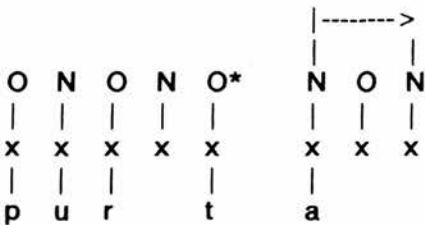


\*Denotes Gradation site

One prediction which follows from this analysis of Class 3 is that such verbs should have an infinitive whose realisation is dependent on the onset preceding. A stem ending in "r" should, after CG and application of the OCP, have an infinitive with an initial "r". Consider <purra> (pur + ta) 'to bite' where the "røt" sequence has gradated to "rød", triggering the OCP and resulting in "rørr".

(102)

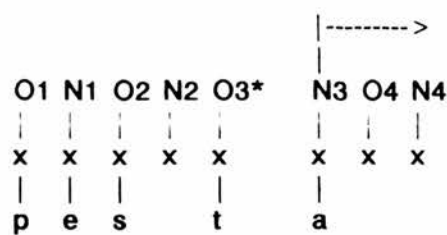
<purra> 'to bite'



Earlier in this chapter we stated that segments which are bound by sharing an H element are immune to gradation. From our hypothesis it follows that Class 3 stems which have a final onset occupied by a segment containing H<sup>i</sup> should display the ungradated form of the infinitive, that is, <ta>. The verb "pesta" 'wash' shows that this is the case:



(103)



The nucleus following the onset occupied by "t", that is N3, is a proper governor. The onset O3 is a potential spot for gradation. O2, however, is occupied by "s" which contains H<sup>+</sup> so that O2 and O3 are bound by their shared element. We predict that O3 will not lenite and that the output form will be <pesta>. As we see, this prediction is correct. We now turn to Class 4.

3.9.3 CLASS FOUR

The penultimate group which we will look at is Class 4. Holman describes these as verbs with infinitives "ending in a vowel followed by ta/tä". Most of the verbs in this group are denominal derivatives:

(104)

Class 4

<halu>	'desire'	<haluta>	'to desire'
<pelko>	'fear'	<pelätä>	'to fear'
<palkka>	'salary'	<palkata>	'to hire'

From the examples in (104) it is apparent that the verb has the gradated form of the consonantism of the noun from which it has been derived (Holman 1990;4). Given our claim that phonological processes apply when their environmental conditions are met, it follows that the syllable structure of the stem is different from that of the noun originator.

I propose that the syllable structure of the verb stem differs from the noun in that it has a final empty onset. This is but another case of the "ghost" consonant discussed above. This empty onset is licensed by a following empty nucleus:

(105)(a) NOUN

O1	N1	O2	N2	O3	N3
x	x	x	x	x	x
p	e	l		k	o

(b) VERB STEM

O1	N1	O2	N2	O3	N3	O4	N4
x	x	x	x	x	x	x	x
p	e	l		k	ä		

The final empty nucleus of the verb stem (N4 in (105b)) needs a proper governor in order to remain empty. N3 acts as a proper governor to the empty position N4, and is no longer able to license O3, which accordingly gradates to  $\emptyset$ .

(106)

O1	N1	O2	N2	O3	N3	O4	N4
x	x	x	x	x	x	x	x
p	e	l			ä		
					<-----		

We add the infinitival <tä> to this stem and the empty onset point is filled by the "t" which is now available to it. This gives us (107):

(107)

						----->					----->		
O1	N1	O2	N2	O3	N3	O4	N4	O5	N5	O6	N6		
x	x	x	x	x	x	x	x	x	x	x	x		
p	e	l			ä	t		<----t	ä				

However, as in the other verbal groups and as shown above, the empty nucleus N6 is also part of the infinitive. It needs to be properly governed. The nucleus immediately to its left N5 then must act as proper governor. As a proper governor it cannot license the geminate "t" which gradates giving the output form <pelätä>:

(108)

						----->					----->		
O1	N1	O2	N2	O3	N3	O4	N4	O5	N5	O6	N6		
x	x	x	x	x	x	x	x	x	x	x	x		
p	e	l		(k)	ä	t		(t)	ä				
				<----				<----					

Holman (1991:4) claims that the first person form of Class 4 verbs is "underivable from the root". I will make a brief deviation from my consideration of infinitives to show that this is not the case when we apply the GP analysis. The first person is formed by the addition of the suffix <an>. Taking the verbal stem of <pelätä> and adding <an> results in:

(109)

[	O1	N1	O2	N2	O3	N3	O4	N4]		N5	O5	N6]]
	x	x	x	x	x	x	x	x		x	x	x
	p	e	l		k	ä				ä	n	

The segmental material of N5 is available to the preceding N4. The non-analytic nature of the morphology means that there are no domains to prevent the material of N5 moving to the left. N4 is now occupied by a full blown vowel. N3 does not have to act as a proper governor to N4 as it is not empty. O3, therefore, does not lenite, and the predicted output form is <pelkäään>:

(110)

O1	N1	O2	N2	O3	N3	O4	N4	O5	N5
x	x	x	x	x	x	x	x	x	x
p	e	l		k	ä		ä	n	

### 3.9.4 CLASS ONE

Finally, I return to Class 1 verbs. These verbs are somewhat different from the other three classes in so far as the only phonetic marker of the infinitive is the single vowel a/ä at the end of the word:

(111)

#### CLASS 1

<antaa>	'to give'	<säättää>	'to regulate'
<oppia>	'to learn'	<nukkua>	'to sleep'

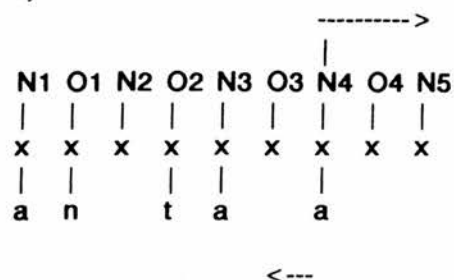
This group displays the infinitive form ghosting effects common to the other three groups. Thus <antaa kirja> 'to give a book' has a geminate "k" in its realisation "anta:k kirja". Given our hypothesis of the previous chapter, where this ghosting effect occurs as the result of spreading into an empty onset position, we must posit an infinitival marker for this class such as that in (112):

(112)



Adding this to a Class 1 stem <antaa> produces:

(113)



In this example, N4, the infinitive "a", must properly govern the empty N5 which immediately follows to its right. The onset which is licensed by N4 however is itself empty, and so the proper government activities of N4 have no effect on its ability to license a particular segment into the preceding onset. Thus the gradation effect of verb Class 2-4 is not visible in Class 1 verbs simply because verbs of this group have an onset in penultimate position which has no segmental material to gradate. Classes 1-4 all have an identical form of the infinitival suffix, but Class 1 differs in that the suffix for this form has an initial empty onset and not one which is filled by the segment "t".<sup>40</sup>

<sup>40</sup>There are, unfortunately, no other striking features, unique to Class 1 Verbs which might explain this difference in the form of the infinitival suffix. It has been pointed out to me, however, (Ene Holman, personal communication) that this is sometimes referred to as the "junk class" as long forms, new loan words and rarely used forms generally belong to Class 1.

In conclusion, we can state that a common syllabic template for the infinitive form, namely ONON, exists. Consonant gradation can be shown to occur without exception in verbal infinitives, given the posited structure, whenever its conditions are met.

CHAPTER FOUR  
DAHL'S LAW IN KIKUYU

4.1 INTRODUCTION

In the last chapter we briefly discussed some data from Kikuyu. This chapter goes on to consider Dahl's Law in more detail. On the surface the Kikuyu facts seem to be in complete contradiction to our statement in the Introduction that phonological processes apply whenever their environmental conditions are met. Pulleyblank (1986) states that Dahl's Law in Kikuyu presents a strong case for the double scan hypothesis of lexical phonology. This chapter will show that no such theoretical device is in fact necessary to account for the occurrence of Dahl's Law and that it, in common with Finnish consonant gradation and Icelandic aspiration, occurs whenever its environmental conditions are met.

4.2 THE DATA

First let us consider the nature of the process as it occurs in Kikuyu (see also Davy and Nurse 1982, Myers 1972, Pulleyblank 1986). Dahl's Law is generally described as a process whereby a voiceless velar stop becomes a voiced velar fricative when the following onset is filled by a voiceless segment.<sup>50</sup>

The process applies from the initial onset of a root to a prefix, as illustrated by the forms in (1) below:

---

<sup>50</sup>All three of my informants also gave this alternation before 'v' in forms such as ka+voku /gavoku/ 'little rabbit'. This is not in keeping with the usual description of the process which restricts its occurrence to before the voiceless {t,c,k,θ}.

(1)

ka + tahi	/gatahi/	'little locust'
ka + kirupa	/gakirupa/	'little barrel'
ka + coro	/gasoro/	'little trumpet'

In Kembu it also applies with a stem trigger to multiple prefixes, and so we find forms such as:

(2)

a + kaa + ke + ikia	/agaagiikia/	'he will throw it'
a + kaa + ke + kiirja	/agaagekiirja/	'he will file it'

and also with a prefix trigger as in (3):

(3)

ka + ka + ko + ke + hakera	/gagagokehakera/	he painted it for you
----------------------------	------------------	-----------------------

Apparently, it also operates within stems<sup>51</sup> so that a form such as /kota/\* is illicit. Dahl's Law does NOT operate from suffix to root, so we find:

(4)

ku + temek + ek + a	/gutemekeka/ * /gutemegeka/	'to be cuttable'
---------------------	-----------------------------	------------------

Dahl's Law does not operate simultaneously within a root and to a prefix, so we never find forms with initial /g/ which take the /g/ form of a prefix:

---

<sup>51</sup> There are a few exceptions to this, but most of the ones I found were loans, where Dahl's Law, though not impossible, was optional, e.g. /kaku/ or /gaku/ 'cake'.



(5)

ka + geeko      /kageeko/ \*/gageeko/      'little pipe'

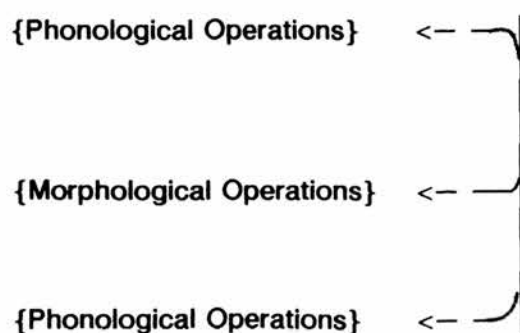
#### 4.3. MY ANALYSIS

This analysis looks at the application of Dahl's Law in terms of domains, as opposed to considering the segmental nature of the process. In order to deal with this issue I first discuss the analysis presented in Pulleyblank 1986 and show how a GB analysis can account for the occurrence of the process without recourse to the strata of Lexical Phonology.

##### 4.3.1 PULLEYBLANK

Pulleyblank (1986) presents the Kikuyu data as support for the 'Double Scan Hypothesis' in Lexical Phonology. The no-failure output of Dahl's law across prefixes makes it, in Lexical Phonology terms; non-cyclic, that is, a process which occurs after all morphological rules have applied rather than after each one. The fact that the process also occurs within stems leads Pulleyblank to argue in favour of the Double Scan Hypothesis:

(6)



Pulleyblank claims that DL operates once BEFORE all morphological derivation (hence its application in stems) and once after, rather than just once after all morphological concatenation is complete.

A form such as "ikia" goes in at level one and submits to any relevant phonological rules. None apply, and so it moves on to the morphological tier. All the morphology is then done in a block; so, for example, <a+kaa+ke+ikia> 'he will throw it', becomes <akaakiikia>. This form then is once again available for the application of phonological rules. Dahl's law applies where it can and "agaagiikia" results.

The double scan mechanism becomes crucial when we next go on to consider a form such as "kogata" 'to cut'. This will start out as the underlying stem "kata". The Double Scan means that phonological rules apply both before and after morphological ones so Dahl's Law will apply immediately, resulting in "gata". In order to make this form an infinitive we must add "ko". This is carried out on the morphology tier and the form "kogata" will then once again be ready to undergo any phonological rules. The form "kogata" does not meet the environmental conditions of Dahl's law and so it does not apply.

Pulleyblank's analysis thus uses the usual tools of Lexical Phonology: cyclic and non-cyclic blocks, rule applications and level ordering, and introduces yet another device, the double scan. In this analysis, as in the previous chapters, we will take the view that such theoretical devices are unnecessary, and that Dahl's Law in common with all phonology simply occurs whenever its environmental conditions are met.

4.3.2 KIKUYU ANALYTIC MORPHOLOGY

Let us begin by making the initial claim that affixes in Kikuyu, like the possessive forms in Finnish and French, are analytic, i.e. that there are domains which remain visible to the phonology. We will begin by looking at multiple application cases of the process - from root to prefix, as shown in (7):

- (7)
- a + kaa + ke + ikia      /agaagiikia/    'he will throw it'

This presents us with domains as follows:-[a[gaa[gi[ikia]]]]

4    3    2    1    234

In this example and in the other examples of Dahl's Law which occur between domains it is the first non-empty onset of the domain which triggers the process. In (7) it is the initial onset of (1), the innermost domain which is the trigger:

- (8)
- "agaagiikia"
- |   |   |   |   |    |   |   |         |       |
|---|---|---|---|----|---|---|---------|-------|
|   |   |   |   |    |   |   | TRIGGER |       |
| 4 |   | 3 |   | 2  |   | 1 |         | 1234  |
| [ | N | [ | O | N  | [ | O | [       | N]]]] |
|   |   |   |   | \  |   |   | \       |       |
| [ | x | [ | x | xx | [ | x | [       | xx    |
|   |   |   |   | /  |   |   | /       | x ]]] |
|   | a |   | g | a  |   | g | i       | k     |
|   |   |   |   |    |   |   |         | ia    |

When the process occurs from prefix to prefix, it is still the first non-empty onset of a domain which acts as trigger.

(9)

ka + ka + ko + ke + hakera /gagagokehakera/ 'he painted it for you'

In this form it is the initial onset of the "ke" ~~prefix~~ i.e. the initial onset of the second domain, marked \* in the (10) below, which initiates the change:

(10)

\*

[ga[ga[go[ke[hakera ]]]]]

5   4   3   2   1            12345

\*

We can formalize this observation then and state that:

(11)

Dahl's Law between domains can only be triggered by a domain-initial onset.

I will claim that the onset projection necessary to go out of a domain and 'see' other domains is only possible to an initial (non-empty) onset. One prediction which follows from this is that the process should not be able to occur with a suffix trigger which can never have a domain-initial onset.<sup>52</sup> As it happens this prediction is correct, as illustrated below:

---

<sup>52</sup>I am grateful to Doug Pulleyblank who pointed out that he can account for the fact that suffixes do not trigger gradation only by means of an ad-hoc stipulation.

(12)

ku + temek + ek + a /gutemekeka/ [gu[[[temek]ek]a]]

4 32 1 2 3 4

The /g/ of the prefix and the /t/ are domain-initial. The initial onset of the suffix will always be preceded by any onset in the stem itself and can therefore never assume the role of trigger.

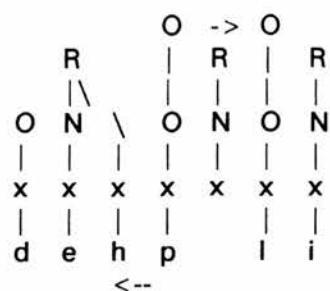
4.3.3 DOMAIN-INTERNAL APPLICATION

Until now we have considered the occurrence of this process between domains. In our last chapter we briefly discussed DL application within domains. We will now return to cases of domain-internal application. The application of DL within a domain is obviously not subject to the condition in (11). Such words as "gek" 'condemn' have a triggering onset which is non-initial in any domain. DL within a domain then applies to any adjacent onsets. An onset can always 'see' an adjacent onset within its own domain and can assume a governing role even when it is not domain-initial and has no projection outside its own domain. A potential triggering onset within a domain is any onset which meets the relevant segmental requirements.

4.3.4 APPLICATION ACROSS DOMAINS

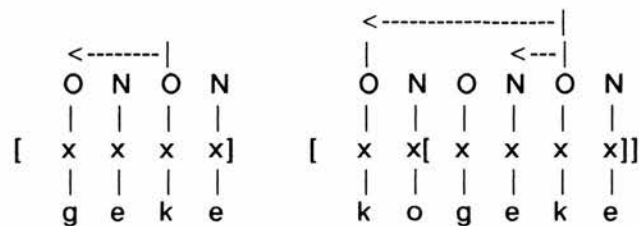
In Icelandic we saw cases where a segment which had a governing role at one level of representation was able to retain that governing role elsewhere. The "p" of "dehpili" 'dot' was a governor of "l" at the level of onset projection. Having assumed this role of projection governor it was also able to govern the preceding rime at the constituent level:

(13)



If, in view of this, we consider a form such as "kogeke", we might predict that the stem final "k" having achieved the status of triggering onset within the domain should be able to retain it throughout the derivation and govern not only the stem initial "k" but also the "k" of the infinitive.

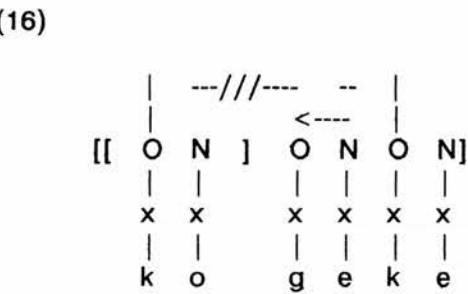
(14)



Added support for this prediction appears to come from the fact that once an onset has become a triggering onset across a domain it may continue to effect the process across any number of domains, as in "gagaaikia" for example. In the previous chapter, however, we saw that there is parametric variation between languages as to whether a segment may act out a role both within and across a domain and the parameter (recalled in (15)) must be reinvoked:

(15) In language X, segments have the ability to perform their licensing roles both within and across domains. Yes/No

In Finnish, we saw that the application of this condition meant that nuclei could both license segments within a domain AND properly govern the following nucleus of a different domain. In Kikuyu, however, segments may not perform both within and across domains, and so the segment which has triggered the domain-internal application cannot do so again across domains. The parameter setting of (15) is set to NO for Kikuyu. The stem final "k" of, for example, "kogeke" may not govern both the initial "k" of the stem and the initial "k" of the infinitive marker:



The strict cycle condition must apply to the already affected stem initial "k". Its transformation to "g" cannot be undone. It cannot resume its status as a potential governor, an initial "k". Neither O2 nor O3 in (16) above is a possible governor for O1. The process cannot apply to O1 because no triggering segment exists and the correct output form "kogeke" is derived.

### 4.3.5 SUMMARY

In conclusion we can see that Dahl's Law in Kikuyu does not in itself provide evidence for lexical phonology and its double scan hypothesis. Dahl's Law occurs whenever there is an onset which is able to trigger it. Only initial onsets can be projected to 'see'

other domains. Suffix onsets are not domain-initial and therefore not potential (trans-domain) triggers. Any onset can affect the process within a domain. The application of parameter (15) in Kikuyu prevents a segment which has achieved governing status domain-internally from continuing to effect it across subsequent domains.



5.0 GENERAL CONTRIBUTIONS OF THE THESIS

5.0.1 PHONOLOGY-MORPHOLOGY INTERFACE

This thesis presents a simplified approach which offers explanatory analysis for a wide variety of phonological phenomena. Specifically, the claims of the approach are:

1. Some morphology is invisible to the phonology (non-analytic).
2. The morphology which is visible to the phonology (analytic morphology) is manifested only in the form of internal domains.
3. The only morphological reference available to the phonology is the domain within principles such as:
  - a. The Coda Licensing Principle
  - b. Domain final empty nucleus licensing.<sup>53</sup>
4. All phonological phenomena apply when their conditions for application are satisfied. No phonological process is limited to a specific 'level'.

When seen in the context of competing theories in the area of the morphology-phonology interface, such as Lexical Phonology, this approach is significantly more restricted.

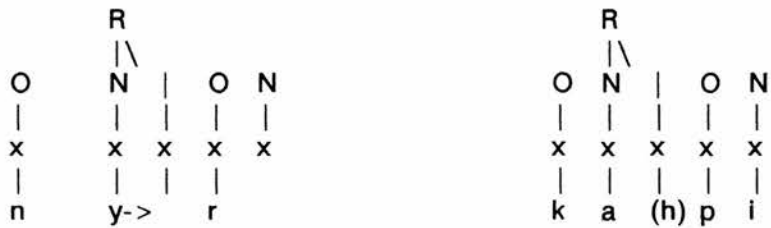
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<sup>53</sup> These are not exhaustive. There are other references to domains within the set of principles. See Charette (1991) for some other examples and the discussion of the Cyclic Spreading Constraint introduced in this thesis.

Within this thesis we have considered a wide and rich variety of data and nowhere are any mechanisms required beyond those discussed above. It would seem rather implausible that languages such as Icelandic, Finnish and Kikuyu can make do with such a restricted system of analysis if other languages would require the considerably more complex structure of Lexical Phonology

In Chapter Two I showed that the vowel lengthening facts of Icelandic can be accounted for by the existence of a branching rime constraint. This constraint is satisfied by preaspiration whenever the environment is appropriate for it to occur. When no onset material is available to the rimal point however it is filled with material from the preceding nucleus.

(1)



In a form such as "ny:r" above I showed that the application of the Cyclic Spreading Constraint prevents the association of the "r" to the metrically created point. The only material available to the rimal point is the preceding vowel which spreads into it. In "kahpi", however, the "p" is lexically geminate and occupies the rime itself by preaspirating into it.

(2)

This rule does not say why vowels should be initially long and then shorten and Arnason, himself, states that a rule lengthening vowels before one consonant would be equivalent in his analysis. An account of the process within Government Phonology avoids these problems.

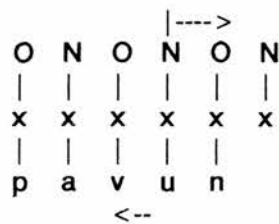
(3)

$$\begin{array}{ccccccc}
 & & & & \text{O} & \text{-----} & \text{O} \\
 & & & & | & & | \\
 & \text{R} & & & | & & | \\
 & | \backslash & & & | & & | \\
 \text{O} & \text{N} & | & & \text{O} & \text{N} & \text{O} & \text{N} \\
 | & | & | & & | & | & | & | \\
 \text{x} & \text{xx} & & & \text{x} & \text{x} & \text{x} & \text{x} \\
 | & | & & & | & & | & \\
 \text{v} & \text{oh} < - & & & \text{p} & & \text{n} & 
 \end{array}$$

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In Chapter Three, I presented a principled analysis of Finnish CG which looked at the nature of gradation as well as its environment. CG is seen as a process which is the result of a reduction in the licensing powers of the nucleus following the affected onset. This means that CG will always occur when a nucleus is overworked:

(4)

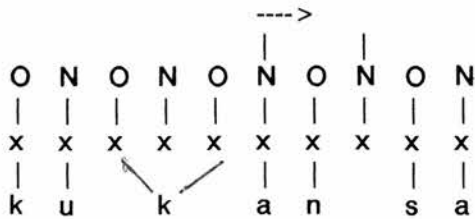


In (4) the "u" of <pavun> must properly govern the final empty nucleus. It is therefore unable to license a full-blown <p> which, accordingly, lenites to "v".

This analysis was extended to the apparently anomalous possessive cases where the CG environment appeared to be met without the process being triggered:

(5)

"kukkansa"



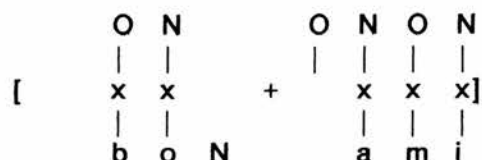
In (5) the "a" following the fake geminate is a potential proper governor to the following empty nucleus between the "ns" and yet the expected lenition of "kk" does not occur. I showed that this form is similar to the French possessive form (Prunet 1986).

(6)

a. son ami

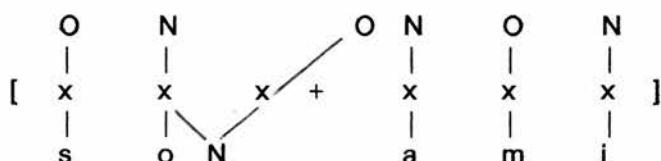


b. bon ami



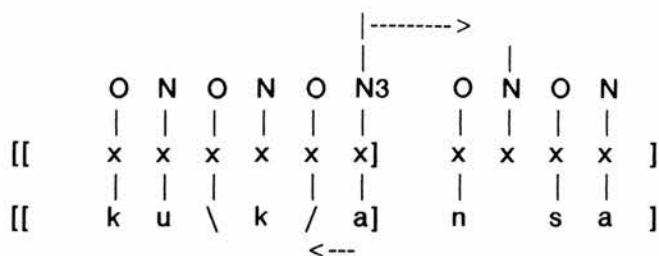
In both <son ami> and <bon ami> there is a floating N which wants to dock onto an available onset. In <bon ami> there is only one domain and an available onset for the N to dock on to. In <son ami> no such onset is available within the inner domain and so it attaches itself to the preceding nucleus. In the outermost domain an onset is available and it also associates to that. The application of the SCC prevents the N from undoing the association it had made in the inner cycle with the result that the form in (7) is created:

(7)



The Finnish possessive, like the French possessive, has a segment performing two roles in two different domains.

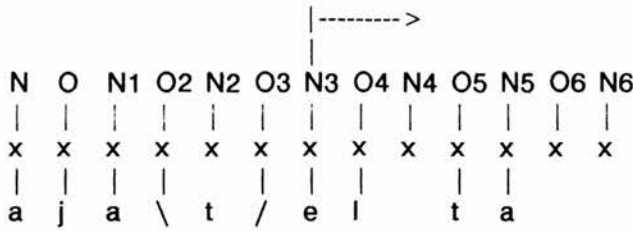
'kukkansa'



The notion of an "inverse gradation" (Holman 1990) process operating in Class 3 verbal forms was shown to be unnecessary when the environment is seen in terms of government relations.

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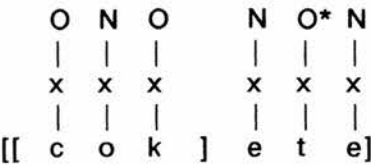
(9)



In (9) we see that N3 must properly govern N4, is no longer to license the geminate of O2 and O3 which, accordingly, lenites.

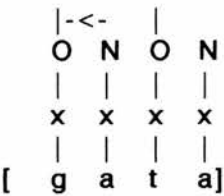
In Chapter Four, the occurrence of Dahl's law was seen to result from the differential behaviour of onsets within and across domains. Pulleyblank (1986) considers DL in Kikuyu as an argument for a further theoretical device of Lexical Phonology: the double scan. Specifically, he claims that DL operates before morphological operations, stem internally, in forms such as "gek" 'condemn'. After morphological rules, DL operates again, deriving a form such "gotheka" (ko + theka) 'laughing'. The fact that suffixes do not trigger the process, in a form such as "cokete" (cok + ete) 'come back', has to be stipulated. By claiming that DL across domains is triggered by domain-initial onsets I was able to show that suffixal onsets could never cause it.

(10)



In (10) we see that the "t" of O\* is not initial in a domain and cannot be projected to 'see' the "k" of the stem. We saw that governors in Kikuyu may govern either within or across a domain, but not both. A form such as <gata> 'cut' has government within a domain:

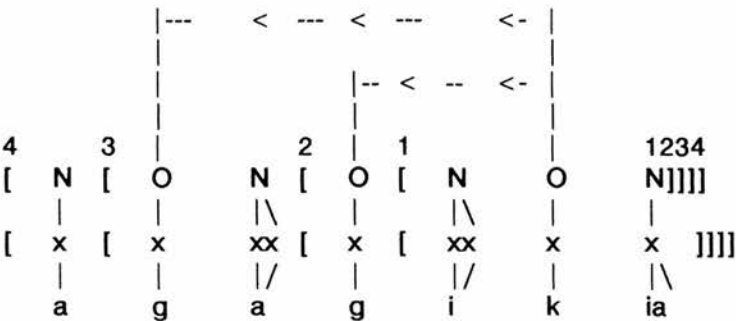
(11)



Prefixes added to it are unaffected by DL, so we find "kogata" 'to cut'. The governing "t" in <gata> is unable to see out of its domain to act in another. Once a segment has governed over a domain, however, it continues to be projected to see other domains resulting in the multiple application of DL in forms such as <agaagiikia> 'he will throw it'.

(12)

"agaagiikia"



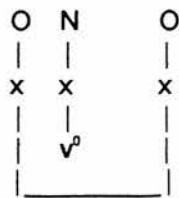


5.1 THEORETICAL CONTRIBUTIONS

We have considered three phenomena which have interested phonologists over the years - Icelandic aspiration, Finnish consonant gradation and Dahl's law in Kikuyu. The analyses have been conducted within a framework which is restricted in its segmental representations, constituent structure and derivations. In the course of the language studies certain theoretical notions have been discussed, expanded and introduced.

Kaye (1990) proposed that nuclei contained within a doubly-linked segment were licensed by virtue of their position. The Icelandic analysis of Chapter Two showed that this notion could be extended so that **any onset to onset governing domain** could license an empty position.

(13) (Kaye 1990)

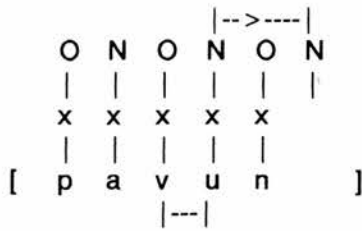


In <vohpn>, the "p" governs the "n" at the level of projection:



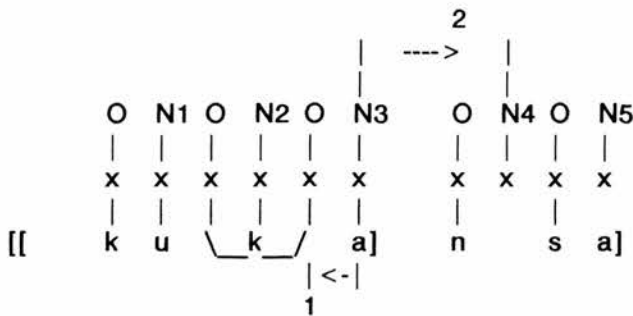
(16)

"pavun" 'bean. gen'



In the same chapter, a parameter was introduced to account for the fact that some languages (such as Finnish) will allow a constituent to perform both within and across domains while others do not. In the Finnish possessive <kukkansa> the "a" of N3 both licenses the preceding geminate in the first domain and properly governs the nucleus N4 in the second domain.

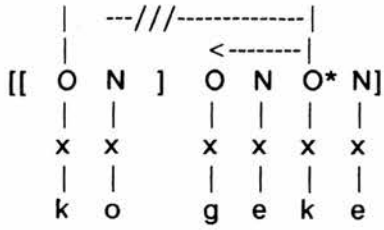
(17)



In (16) above the "u" is unable to perform both actions because both duties are within the same domain. The process of DL in Kikuyu showed that, in contrast with Finnish, Kikuyu did not allow segments which had performed within a domain to assume a role across subsequent domains:

(18)

<kogeke> 'to cut'



The O\* in (18) governs the preceeding onset, but is unable to have any relationship with the initial onset. Having acted once, within its own domain, the "k" of O\* cannot assume a role in a new domain.

## 5.2 CONCLUSION

The languages discussed in this thesis are all members of different 'language families'. On the surface their differences might be said to far outnumber any similarities. Given the diversity of the languages considered here, and the restrictiveness of a principles and parameter approach to grammar, it seems certain that something much more concrete than chance must lie behind the success of the approach. I hope that this thesis has been another step towards showing:

...that the structure of language is determined by the structure of the human mind and that the universality of certain properties characteristic of a language is common to all members of the species, regardless of their race or class and their undoubted differences in intellect, personality and physical attributes.

Noam Chomsky "Reflections on Language" (1976)

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